

March 27, 2012

## **ADDENDUM NO. 2**

**SUBJECT: WPCF GREASE RECEIVING AND PROCESSING FACILITY,  
PROJECT NO. 613-7511**

**REVISED BID OPENING DATE: TUESDAY, APRIL 3, 2012**

**TO ALL PROSPECTIVE BIDDERS:**

This Addendum and its attachment shall be attached to, and form a part of, the plans and specifications for the construction of the subject project.

**Due to the large number of pages, the attachments will not be mailed out with this Addendum. All the attachments are available for download at the City of Hayward website,**

[http://www.hayward-ca.gov/departments/publicworks/documents/2012/Addendum\\_No.\\_2-WPCF\\_Grease\\_Receiving\\_and\\_Processing\\_Facility\\_PN613-7511.pdf](http://www.hayward-ca.gov/departments/publicworks/documents/2012/Addendum_No._2-WPCF_Grease_Receiving_and_Processing_Facility_PN613-7511.pdf)

This addendum will be presented to the City Council for approval at Award of Contract. Your bid should be based on the Contract Documents, as modified by this Addendum.

Sincerely,

MORAD FAKHRAI

Director of Public Works - Engineering and Transportation/City Engineer

**DEPARTMENT OF PUBLIC WORKS  
ENGINEERING & TRANSPORTATION**

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SUBJECT: WPCF GREASE RECEIVING AND PROCESSING FACILITY,  
PROJECT NO. 613-7511

The following Addendum No. 2 to the subject project's plans and specifications shall be taken into consideration in the preparation of your bid.

### RESPONSE TO BIDDERS' QUESTIONS

1. *Question: It is not clear to what size the #3 water line is supposed to be. Each sheet calls for a different size. Can you please clarify?*  
ANSWER: The required size is 2 1/2 inches.
2. *Question: The specifications do not state what the lining or coating should be on the 56" of 20" steel pipe that gets replaced. It also fails to state what schedule the steel pipe is (40 or 80). Please clarify.*  
ANSWER: The size of the discharge pipe on Pump 67(E) is 20". The diameter tapers to 12" near the downstream end. Schedule 40 is required. Section 9900, Painting, covers the coating specification. The pipe is to be unlined.
3. *Question: There are no tie in details pertaining to the #3 water tie in at the existing hydrant. Can you please clarify how you intend to tie the new line into the existing hydrant.*  
ANSWER: A detail is added to Drawings Sheet 13, PIPE TRENCH & CONTAINMENT STRUCTURE DETAILS.
4. *Question: Can you please indicate which pipe support detail you wish for the contractor to use? Please indicate the spacing at which you wish for the supports be placed.*  
Answer: Defined by notes on Drawings Sheet 9, "INJECTION LINE."
5. *Question: On the drawings there are numerous call outs for sizes of pipe and valve locations that conflict with other drawings. Can you please indicate which drawing prevails over the rest? i.e. P&ID, Process Schematic, Mechanical.*  
ANSWER: Mechanical prevails.
6. *Question: Sheet 6 shows a flowmeter on the discharge side of the grinder on the line feeding the tank. This flowmeter is not shown on sheet 8 in the Fog Feed profile. Please clarify the discrepancy.*  
ANSWER: The flowmeter will be removed from Drawings Sheet 6, INJECTION & GRINDER-RECEIVING LINES.
7. *Question: Also on the fog feed profile on sheet 8, the fog feed piping feeding the tank is shown with welded or solvent welded pipe joints with welded steel supports, no longer flanged ductile like the remainder of the fog piping system. Is this line pvc or steel and if so what are the piping requirements?*

ANSWER: Piping not shown with flanged ends is to be schedule 40 steel, unless otherwise specifically called out. Piping supports connected to the tank are to be designed by and provided by the tank manufacturer.

8. *Question: Sheet 6 shows a plug valve and check valve on the discharge side of Grinder / Fog Feed system. This valve configuration is not shown on mechanical piping sheets 4 and 8. Please confirm they are not required per the mechanical plans.*

ANSWER: The mechanical plans, Drawings Sheets 4 and 8, will be edited to include these valves.

9. *Question: Piping Schedule on page 6 of section 15060 does not provide a piping system for the #3 water required. Is the fire hydrant supplying the #3 water to the grinder a 4" or 6" hydrant and will a hot tap be required?*

ANSWER: A connection detail will be provided on Drawings Sheet 13, PIPE TRENCH & CONTAINMENT STRURE DETAILS. A hot tap will not be required.

10. *Question: I would like to request an email copy of the Geo-Technical Report for this project. I would also like to know if you have any documents giving the existing finish grade elevations of asphalt in the project area. We are unable to calculate the required excavation without knowing the existing elevations.*

ANSWER: The report is available on the City of Hayward Website.

11. *Question: Also, please provide the existing thickness of AC and AB to be removed and what will be required for the patch paving.*

ANSWER: The existing AC pavement varies in thickness but is unknown. The minimum patch or replacement thickness is 4", see Drawings Sheet 13, PIPE TRENCH & CONTAINMENT STRUCTURE DETAILS.

12. *Question: Let me know if you can provide a detail for the attachment of the containment wall to the Digester. Will we be doweling into the digester?*

ANSWER: Provide caulking between tank wall and containment wall. Do not dowel into the existing tank wall.

## **SPECIAL PROVISIONS**

The items below revise the Special Provisions as indicated:

13. Replace paragraph 3.7 of Section 15060, Pipe and Piping systems, marked Addendum 2, with attached page showing revised paragraph 3.7
14. Replace Section 13440, Instrumentation for Process Control: Basic Requirements, Marked Addendum 2 with attached 8 pages of same title and section number.
15. Add the following new specification sections:
  - a. 16010 Electrical: Basic Requirements, marked Addendum 2, having 12 pages.
  - b. 16060 Grounding, marked Addendum 2, having 4 pages.

16. Replace Section 13200, Welded Steel Mix/Storage Tank, marked Addendum 2 with the attached 6 pages of same title and section number.
17. Replace Section 11385, Pumps, marked Addendum 2 with the attached 4 pages of same title and section number.
18. Delete third paragraph of Section 5-1.19 Permits and Licenses; replace it with the following:

The Contractor shall be responsible to secure the following no-charge City permits prior to construction mobilization:

- a. Electrical
  - b. Building
  - c. Plumbing
- 
19. Add the following paragraph to the end of Section 10-1.03 Cooperation: The Contractor shall coordinate needed treatment plant operational interruptions for interconnections with the following existing plant components.
    - a. North Vacuum Scum Line
    - b. Digester 1 Sludge to Waste Line
    - c. Digester 1 Feed Line
    - d. Electrical connections to MCC 16 and to SCADA.
    - e. #3 Water.

Interruptions will be limited to 4 hours per component interconnection. Interruptions must be requested at least 3 working days in advance of actual component interruption. Not more than one interruptions per day will be allowed and the actual date/time to be allowed will depend upon ongoing plant operations.

## **PLANS**

The items below revise the Plans as indicated:

20. Replace drawing sheets 1 to 22 with same numbered drawings sheets marked “Revised Per Addendum #2”.
21. Insert drawings sheet 13A, SITE ELEVATION POINTS into the drawing set.

## **ATTACHMENTS:**

1. Revised Section 15060 (1 page)
2. Revised Section 13440 (8 pages)
3. Section 16010 (12 pages)
4. Section 16060 (4 pages)
5. Revised Section 13200 (6 pages)
6. Revised Section 11385 (4 pages)
7. Revised Plan Sheet 1 thru 23 (23 pages)

**All the attachments are available for download at the City of Hayward website,**

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--- END OF ADDENDUM---

### 3.7 PIPING SCHEDULES

#### PIPING SCHEDULE

##### Piping Components

<u>Duty</u>	<u>Material</u>	<u>Class</u>	<u>Joints</u>
Drainage	PVC	SDR 35	Elastomeric Bell and Spigot Solvent weld
FOG above ground	Ductile Iron, Cement Lined	Class 250	Flanged
FOG underground	PVC	Scd 40, Type 1, Grade 1	Solvent weld
Odor Control	PVC	Scd 40, Type 1, Grade 1	Solvent weld
Overflow	Ductile Iron, unlined	Class 250	Flanged
	Steel, unlined	Scd 40	Welded
Drain pipe`	Ductile Iron, unlined	Class 250	Flanged
	Steel, unlined	Scd 40	Welded

**SECTION 13440**  
**INSTRUMENTATION FOR PROCESS CONTROL:**  
**BASIC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Basic requirements for complete instrumentation system for process control.

**1.2 QUALITY ASSURANCE**

A. Referenced Standards:

1. Canadian Standards Association (CSA).
2. FM Global (FM).
3. The Instrumentation, Systems, and Automation Society (ISA):
  - a. 7.0.01, Quality Standard for Instrument Air.
  - b. S5.1, Instrumentation Symbols and Identification.
  - c. S5.3, Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems.
  - d. S5.4, Standard Instrument Loop Diagrams.
  - e. S20, Standard Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
4. National Electrical Manufacturers Association (NEMA):
  - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
5. National Fire Protection Association (NFPA):
  - a. 70, National Electrical Code (NEC).
6. National Institute of Standards and Technology (NIST).
7. Underwriters Laboratories, Inc. (UL):
  - a. 913, Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.

B. Qualifications:

1. Instrumentation subcontractor:
  - a. Experience:
    - 1) Have satisfactorily provided a control system for a minimum of five (5) projects of similar magnitude and function.

C. Miscellaneous:

1. Comply with electrical classifications and NEMA enclosure types shown on Drawings.

**1.3 SYSTEM DESCRIPTION**

A. Control System Requirements:

1. This Specification Section provides the general requirements for the instrument and control system.
2. The instrument and control system consists of all primary elements, transmitters, switches, controllers, computers, recorders, indicators, panels, signal converters, signal boosters, amplifiers, special power supplies, special or shielded cable, special grounding or isolation, auxiliaries, software, wiring, and other devices required to provide complete control of the plant as specified in the Contract Documents.

B. All signals shall be directly linearly proportional to measured variable unless specifically noted otherwise.

C. Single Instrumentation Subcontractor:



1. Furnish and coordinate instrumentation system through a single instrumentation subcontractor.
  - a. The instrumentation subcontractor shall be responsible for functional operations of all systems, performance of control system engineering, supervision of installation, final connections, calibrations, preparation of Drawings and Operation and Maintenance Manuals, start-up, training, demonstration of substantial completion and all other aspects of the control system.
2. Ensure coordination of instrumentation with other work to ensure that necessary wiring, conduits, contacts, relays, converters, and incidentals are provided in order to transmit, receive, and control necessary signals to other control elements, to control panels, and to receiving stations.

#### 1.4 SUBMITTALS

##### A. Shop Drawings:

1. Submittals shall be original printed material or clear unblemished photocopies of original printed material.
  - a. Facsimile information is not acceptable.
2. Limit the scope of each submittal to one (1) Specification Section.
  - a. Each submittal must be submitted under the Specification Section containing requirements of submittal contents.
3. Product technical data including:
  - a. Equipment catalog cut sheets.
  - b. Instrument data sheets:
    - 1) ISA S20 or approved equal.
    - 2) Separate data sheet for each instrument.
  - c. Materials of construction.
  - d. Minimum and maximum flow ranges.
  - e. Pressure loss curves.
  - f. Physical limits of components including temperature and pressure limits.
  - g. Size and weight.
  - h. Electrical power requirements and wiring diagrams.
  - i. NEMA rating of housings.
  - j. Submittals shall be marked with arrows to show exact features to be provided.
4. PLC/DCS equipment drawings.
5. Nameplate layout drawings.
6. Drawings, systems, and other elements are represented schematically in accordance with ISA S5.1 and ISA S5.3.
  - a. The nomenclature, tag numbers, equipment numbers, panel numbers, and related series identification contained in the Contract Documents shall be employed exclusively throughout submittals.
7. All Shop Drawings shall be modified with as-built information/corrections.
8. All panel and wiring drawings shall be provided in both hardcopy and softcopy.
  - a. Furnish electronic files on CD-ROM or DVD-ROM media.
  - b. Drawings in AUTOCAD 08 format.
9. Provide a parameter setting summary sheet for each field configurable device.
10. Certifications:
  - a. Documentation verifying that calibration equipment is certified with NIST traceability.
  - b. Approvals from independent testing laboratories or approval agencies, such as UL, FM or CSA.
    - 1) Certification documentation is required for all equipment for which the specifications require independent agency approval.
11. Testing reports: Source quality control reports.

##### B. Operation and Maintenance Manuals:

1. Warranties: Provide copies of warranties and list of factory authorized service agents.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Do not remove shipping blocks, plugs, caps, and desiccant dryers installed to protect the instrumentation during shipment until the instruments are installed and permanent connections are made.

## **1.6 SITE CONDITIONS**

- A. Unless designated otherwise on the Drawings, area designations are as follows:
  - 1. Outdoor area:
    - a. Wet.
    - b. Corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.
    - c. Below grade vaults and manholes:
      - 1) Subject to temporary submergence when specifically designated on the Drawings or Specifications.

## **PART 2 - PRODUCTS**

### **2.1 NEMA TYPE REQUIREMENTS**

- A. Provide enclosures/housing for control system components in accordance with the following:
  - 1. Areas designated as wet and/or corrosive: NEMA Type 4X.
  - 2. Areas designated as Class I hazardous, Groups A, B, C, or D as defined in NFPA 70:
    - a. NEMA Type 7 unless all electrical components within enclosure utilize intrinsically safe circuitry.
      - 1) Utilize intrinsically safe circuits to the maximum extent practical and as depicted in the Contract Documents.
  - 3. Areas designated as Class II hazardous, Groups E, F, or G as defined in NFPA 70:
    - a. NEMA Type 9 unless all electrical components within enclosure utilize intrinsically safe circuitry.
      - 1) Utilize intrinsically safe circuits to the maximum extent practical and as depicted in the Contract Documents.

### **2.2 PERFORMANCE AND DESIGN REQUIREMENTS**

- A. System Operating Criteria:
  - 1. Stability: After controls have taken corrective action, as result of a change in the controlled variable or a change in setpoint, oscillation of final control element shall not exceed two (2) cycles per minute or a magnitude of movement of 0.5 percent full travel.
  - 2. Response: Any change in setpoint or change in controlled variable shall produce a corresponding corrective change in position of final control element and become stabilized within 30 seconds.
  - 3. Agreement: Setpoint indication of controlled variable and measured indication of controlled variable shall agree within 3 percent of full scale over a 6:1 operating range.
  - 4. Repeatability: For any repeated magnitude of control signal, from either an increasing or decreasing direction, the final control element shall take a repeated position within 0.5 percent of full travel regardless of force required to position final element.
  - 5. Sensitivity: Controls shall respond to setpoint deviations and measured variable deviations within 1.0 percent of full scale.
  - 6. Performance: All instruments and control devices shall perform in accordance with manufacturer's specifications.

### **2.3 MAGNETIC FLOW METERS:**

- 1. Acceptable manufacturers:
  - a. ABB. MagMaster MFE to match existing.
  - b. No equal.

2. Design and fabrication:
  - a. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.
  - b. High input impedance pre-amplifiers.
    - 1) Minimum impedance:  $10^{10}$  ohms.
  - c. Provide {flanged end connections per ASME B16.5} {mechanical coupling end connections} {wafer body design} rated for piping system operating and test conditions.
  - d. Operating pressure: 60 psi.
  - e. Operating temperature: 80 DegF.
  - f. Grounding requirements:
    - 1) Nonmetallic or lined pipe:
      - a) Inlet and outlet grounding rings of same material as electrode.
    - 2) Conductive piping:
      - a) Conductive path between the meter and the piping flanges.
  - g. Provide cable between magnetic flow meter and transmitter.
  - h. Pulsed DC magnetic field excitation.
  - i. Automatic zero.
  - j. Adjustable low flow cutoff.
  - k. Minimum signal lock (empty tube zero) to prevent false measurement when tube is empty.
  - l. Inaccuracy:
    - 1) Above 10 percent of range:  $\pm 1.0$  percent of rate.
    - 2) Below 10 percent of range:  $\pm 0.1$  percent of range setting.
    - 3) Add  $\pm 0.1$  percent of range to above inaccuracies for analog outputs.
  - m. 4-20 mA DC isolated output into maximum 800 ohms.
  - n. Power supply: 117 V  $\pm 10$  percent, 60 Hz.
  - o. Indication of flow rate and totalized flow at transmitter.
  - p. Meter operable as specified in liquids with 5.0 micro mho/cm or more conductivity.
  - q. Transmitter electronics shall use microprocessor based architecture and be configured using parameters.

#### 2.4 PRESSURE SWITCHES:

1. Acceptable manufacturers:
  - a. Mercooid.
  - b. Automatic Switch Company.
  - c. United Electric.
2. Materials:
  - a. Wetted switch elements: 316 stainless steel.
  - b. Diaphragm seal housing: 316 stainless steel.
  - c. Pressure snubber:
    - 1) Filter disc: 316 stainless steel.
    - 2) Housing: 316 stainless steel}.
3. Accessories:
  - a. Provide ball valve to isolate pressure switch from source.
  - b. Utilize pressure snubbers with porous metal discs to provide pulsation dampening on pressure switch as shown on schedule.
  - c. On applications where a pressure switch and a pressure gage are used at the same location, it is permissible to utilize one (1) pulsation dampener and diaphragm seal to isolate both elements from the process fluid.
4. Design and fabrication:
  - a. Utilize hermetically sealed mercury contact switches.
  - b. Two (2) SPDT contacts rated:
    - 1) 1 amp inductive at 125 Vdc.
    - 2) 5 amp inductive at 120 Vac.
  - c. Switch set points:

- 1) Above 1,000 psi:
  - a) Between 30 and 35 percent of switch rated working range.
  - b) Operating pressure range not to exceed 35 percent of switch rated working pressure.
- 2) Below 1,000 psi:
  - a) Set points between 30 and 70 percent of switch rated working range.
  - b) Operating pressure not to exceed 75 percent of switch rated working range.
- d. Accuracy: Better than 1 percent of full scale.
- e. Process connection: Minimum of 1/4 IN.

## 2.5 PRESSURE GAGE:

1. Acceptable manufacturers:
  - a. Ashcroft.
  - b. Ametek.
2. Materials:
  - a. Bourdon tube, socket, connecting tube: 316 stainless steel.
  - b. Case: Phenolic.
  - c. Pressure snubber:
    - 1) Filter disc: 316 stainless steel.
    - 2) Housing: 316 stainless steel.
3. Accessories:
  - a. Provide valve at point of connection to equipment and at panel if panel mounted.
  - b. Utilize pressure snubbers with porous metal discs to provide pulsation dampening on gage applications as shown on schedule.
  - c. Provide 1/2 IN stainless steel antisiphon pigtail inlet connection for hot water and steam applications.
4. Design and fabrication:
  - a. All components suitable for service at:
    - 1) 250 DegF.
    - 2) The maximum process temperature to which the gage is to be exposed.
  - b. Provide viewer protection from element rupture.
  - c. Calibrate gages at jobsite for pressure and temperature in accordance with manufacturer's instructions.
  - d. Unless otherwise required by codes, provide stem mounted or flush mounted, as required, with dial diameter as follows:

PIPE SIZE	DIAL SIZE	GAGE CONNECTION
1-1/2 IN or less	2-1/2 IN	1/4 IN
Larger than 1-1/2 IN	4-1/2 IN	1/2 IN

- e. Equip with white faces, black numerals and black pointers.
- f. Gage tapping position to be clear of equipment functions and movements, and protected from maintenance and operation of equipment.
  - 1) Gage to be readable from an accessible standing position.
- g. Gage accuracy: 1 percent of full range.
- h. Select gage range so that:
  - 1) The normal operating value is in the middle third of the dial.
  - 2) Maximum operating pressure does not exceed 75 percent of the full scale range.

## 2.6 IN-LINE ISOLATION SLEEVE (ANNULAR SEAL):

1. Acceptable manufacturers:
  - a. Ametek.
  - b. Red Valve.
2. Materials:
  - a. Body: 316 stainless steel.
  - b. Flanges: 316 stainless steel.

- c. Flexible liner: Buna-N.
- 3. Design and fabrication:
  - a. Provide full 360 degree annular pressure sensor with flexible in-line sleeve.
  - b. Sensor shall not restrict the process flow (non-intrusive).
  - c. Seal shall have wafer.
    - 1) Line size as shown on the Drawings.
  - d. Instrument connection: 0.25 IN female NPT.
  - e. Fill fluid:
    - 1) Utilize halocarbon fill for process applications involving strong oxidizing agents.
      - a) Agents include but are not limited to: Cl<sub>2</sub>, KMNO<sub>4</sub>, FeCl, NaOH, and NaOCl.
    - 2) Utilize manufacturer's standard fill for other applications.
      - a) Ensure fill is suitable for application temperatures.
  - f. Pressure rating: To meet requirements of schedule.

## **2.7 FLOAT-TILT TYPE LEVEL SWITCHES:**

- 1. Acceptable manufacturers:
  - a. Anchor Scientific Inc.
  - b. Consolidated Electric.
- 2. Materials:
  - a. Float material: Teflon coated type 316 stainless steel.
  - b. Cable jacket: PVC, neoprene.
  - c. Cable clamp: 316 stainless steel.
- 3. Design and fabrication:
  - a. Sealed non-mercury switch in float.
  - b. Provide switch complete with flexible electrical cables.
  - c. SPDT contact rated at 4.5 amp at 120 Vac.
  - d. Direct acting float switch:
    - 1) Switch actuates on rising level.
    - 2) Switch deactuates when liquid falls 1 IN below actuation level.
  - e. Terminate cables in junction box.
  - f. Install floats per Drawing details.

## **2.8 ULTRASONIC LEVEL SENSOR AND TRANSMITTER:**

- 1. Acceptable manufacturers:
  - a. Siemens Hydroranger 200.
- 2. Materials:
  - a. Sensor wetted parts: polyvinylidene fluoride (PVDF).
- 3. Design and fabrication:
  - a. Sensor:
    - 1) Emits ultrasonic sound.
    - 2) Detects return echo reflected from surface and converts it to electrical energy proportional to level.
  - b. Temperature compensated.
  - c. Capable of being configured to ignore false targets.
  - d. Operating temperature: -4 to 140 DegF.
  - e. Humidity: 95 percent non-condensing.
  - f. Transmitter:
    - 1) Capable of producing output signal proportional to level of 4-20 mA DC into 500 ohm load.
    - 2) Power supply: 120 Vac (+/-10 percent), 60 Hz.
    - 3) Inaccuracy: 0.25 percent of range or 0.24 IN, whichever is greater.
    - 4) Resolution: 0.1 percent of span or 0.08 IN, whichever is greater.
    - 5) Display: Four-digit LED or LCD scalable to engineering units with selectable decimal point.
    - 6) Temperature: -5 to 122 DegF.

- 7) Humidity: 95 percent noncondensing.
- 8) Memory: EEPROM (non-volatile).
- 9) Keypad programmer.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Wherever feasible, use bottom entry for all conduit entry to instruments and junction boxes.
- B. Install electrical components per Division 16.
- C. Panel-Mounted Instruments:
  1. Mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
  2. Locate all devices mounted inside enclosures so terminals and adjustment devices are readily accessible without use of special tools and with terminal markings clearly visible.

### **3.2 FIELD QUALITY CONTROL**

- A. Maintain accurate daily log of all startup activities, calibration functions, and final setpoint adjustments.
  1. Documentation requirements include the utilization of the forms located at the end of this Specification Section.
    - a. Loop Check-out Sheet.
    - b. Instrument Certification Sheet.
    - c. Final Control Element Certification Sheet.
- B. Instrumentation Calibration:
  1. Verify that all instruments and control devices are calibrated to provide the performance required by the Contract Documents.
  2. Calibrate all field-mounted instruments, other than local pressure and temperature gages, after the device is mounted in place to assure proper installed operation.
  3. Calibrate in accordance with the manufacturer's specifications.
  4. Bench calibrate pressure and temperature gages.
    - a. Field mount gage within seven (7) days of calibration.
  5. Check the calibration of each transmitter and gage across its specified range at 0, 25, 50, 75, and 100 percent.
    - a. Check for both increasing and decreasing input signals to detect hysteresis.
  6. Replace any instrument which cannot be properly adjusted.
  7. Stroke control valves with clean dry air to verify control action, positioner settings, and solenoid functions.
  8. Calibration equipment shall be certified by an independent agency with traceability to NIST.
    - a. Certification shall be up-to-date.
    - b. Use of equipment with expired certifications shall not be permitted.
  9. Calibration equipment shall be at least three (3) times more accurate as the device being calibrated.
- C. Loop check-out requirements are as follows:
  1. Check control signal generation, transmission, reception and response for all control loops under simulated operating conditions by imposing a signal on the loop at the instrument connections.
    - a. Use actual signals where available.
    - b. Closely observe controllers, indicators, transmitters, HMI displays, recorders, alarm and trip units, remote setpoints, ratio systems, and other control components.
      - 1) Verify that readings at all loop components are in agreement.
      - 2) Make corrections as required.
        - a) Following any corrections, retest the loop as before.

## ADDENDUM 2

2. Stroke all control valves, cylinders, drives and connecting linkages from the local control station and from the control room operator interface.
  3. Check all interlocks to the maximum extent possible.
  4. In addition to any other as-recorded documents, record all setpoint and calibration changes on all affected Contract Documents and turn over to the Owner.
- D. Provide verification of system assembly, power, ground, and I/O tests.
- E. Verify existence and measure adequacy of all grounds required for instrumentation and controls.

### **END OF SECTION**

**SECTION 16010**  
**ELECTRICAL: BASIC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Basic requirements for electrical systems.

**1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. Aluminum Association (AA).
  - 2. American Iron and Steel Institute (AISI).
  - 3. ASTM International (ASTM):
    - a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
    - b. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 4. ETL Testing Laboratories (ETL).
  - 5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - a. C2, National Electrical Safety Code (NESC).
  - 6. National Electrical Manufacturers Association (NEMA):
    - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 7. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC).
  - 8. Underwriters Laboratories, Inc. (UL).
- B. Where UL test procedures have been established for the product type, use UL or ETL approved electrical equipment and provide with the UL or ETL label.

**1.3 DEFINITIONS**

- A. For the purposes of providing materials and installing electrical work the following definitions shall be used.
  - 1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
  - 2. Architecturally finished interior area: Offices, laboratories, conference rooms, restrooms, corridors and other similar occupied spaces.
  - 3. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
  - 4. Highly corrosive and corrosive area: Areas identified on the Drawings where there is a varying degree of spillage or splashing of corrosive materials such as water, wastewater or chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes or chemical mixtures.
  - 5. Hazardous areas: Class I, II or III areas as defined in NFPA 70.
  - 6. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

**1.4 SUBMITTALS**

- A. Shop Drawings:
  - 1. General requirements:
    - a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
    - b. Include data sheets that include manufacturer's name and product model



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number.

- 1) Clearly identify all optional accessories.
- c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components.
- d. Manufacturer's delivery, storage, handling and installation instructions.
- e. Product installation details.
- f. See individual specification sections for any additional requirements.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect nameplates on electrical equipment to prevent defacing.

### 1.6 AREA DESIGNATIONS

- A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
  1. Outdoor areas:
    - a. Wet.
    - b. Also, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.
  2. Indoor areas:
    - a. Dry.
    - b. Also, wet, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, refer to specific Division 16 Specification Sections and specific material paragraphs below for acceptable manufacturers.
- B. Submit request for substitution in accordance with Specification Section 01640.
- C. Provide all components of a similar type by one (1) manufacturer.

### 2.2 MATERIALS

- A. Electrical Equipment Support Pedestals and/or Racks:
  1. Approved manufacturers:
    - a. Modular strut:
      - 1) Unistrut Building Systems.
      - 2) B-Line.
      - 3) Globe Strut.
  2. Material requirements:
    - a. Modular strut:
      - 1) Galvanized steel: ASTM A123 or ASTM A153.
      - 2) Stainless steel: AISI Type 316.
      - 3) PVC coated galvanized steel: ASTM A123 or ASTM A153 and 20 mil PVC coating.
      - 4) Aluminum: AA Type 6063-T6.
    - b. Mounting hardware:
      - 1) Galvanized steel.
      - 2) Stainless steel.
    - c. Anchorage per Specification Section 05505.
- B. Field touch-up of galvanized surfaces.
  1. Zinc-rich primer.
    - a. One (1) coat, 3.0 mils, ZRC by ZRC Products.

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- C. Subject to compliance with the Contract Documents, the following manufacturers of wire are acceptable:
1. Building wire, power and control cable and multiplex cable:
    - a. American Insulated Wire Corporation.
    - b. General Cable.
    - c. Manhattan/CDT.
    - d. Southwire Company.
  2. Instrumentation cable:
    - a. Analog cable:
      - 1) Alpha Wire Corporation.
      - 2) American Insulated Wire Corporation.
      - 3) Belden CDT Inc.
      - 4) General Cable.
      - 5) Manhattan/CDT.
  3. Wire connectors:
    - a. Burndy Corporation.
    - b. Buchanan.
    - c. Ideal.
    - d. Ilsco.
    - e. 3M Co.
    - f. Teledyne Penn Union.
    - g. Thomas and Betts.
    - h. Phoenix Contact.
  4. Insulating and color coding tape:
    - a. 3M Co.
    - b. Plymouth Bishop Tapes.
    - c. Red Seal Electric Co.
- D. Building Wire:
1. Conductor shall be copper with 600 V rated insulation.
  2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits which may be stranded or solid.
  3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
  4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and THHN/THWN-2 insulation.
  5. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.
- E. Power Cable:
1. Conductor shall be copper with 600 V rated insulation.
  2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
  3. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.
  4. Number of conductors as required, including a bare ground conductor.
  5. Individual conductor color coding:
    - a. ICEA Method 4.
    - b. See PART 3 of this Specification Section for additional requirements.
- F. Control Cable:
1. Conductor shall be copper with 600 V rated insulation.
  2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
  3. Conform to NEMA/ICEA WC 57/S-73-532 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.
  4. Number of conductors as required, provided with or without bare ground conductor of the same AWG size.
    - a. When a bare ground conductor is not provided, an additional insulated conductor

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shall be provided and used as the ground conductor (e.g., 6/c No. 14 w/g and 7/c No. 14 are equal).

5. Individual conductor color coding:
  - a. NEMA/ICEA Method 1, Table E-2.
  - b. See Part 3 of this Specification for additional requirements.
- G. Electrical Equipment Control Wire:
  1. Conductor shall be copper with 600 V rated insulation.
  2. Conductors shall be stranded.
  3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
  4. Conform to UL 44 for Type SIS insulation.
  5. Conform to UL 83 for Type MTW insulation.
- H. Instrumentation Cable:
  1. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
  2. Analog cable:
    - a. Tinned copper conductors.
    - b. 600 V PVC insulation with PVC jacket.
    - c. Twisted with 100 percent foil shield coverage with drain wire.
    - d. Six (6) twists per foot minimum.
    - e. Individual conductor color coding: ICEA Method 1, Table K-2.
- I. Wire Connectors:
  1. Twist/screw on type:
    - a. Insulated pressure or spring type solderless connector.
    - b. 600 V rated.
    - c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
    - d. Phase and neutral conductors: Conform to UL 486C.
  2. Compression and mechanical screw type:
    - a. 600 V rated.
    - b. Ground conductors: Conform to UL 467.
    - c. Phase and neutral conductors: Conform to UL 486A.
  3. Terminal block type:
    - a. High density, screw-post barrier-type with white center marker strip.
    - b. 600 V and ampere rating as required, for power circuits.
    - c. 600 V, 20 ampere rated for control circuits.
    - d. 300 V, 15 ampere rated for instrumentation circuits.
    - e. Conform to NEMA ICS 4 and UL 486A.
- J. Insulating and Color Coding Tape:
  1. Pressure sensitive vinyl.
  2. Premium grade.
  3. Heat, cold, moisture, and sunlight resistant.
  4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.
  5. For cold weather or outdoor location, tape must also be all-weather.
  6. Color:
    - a. Insulating tape: Black.
    - b. Color coding tape: Fade-resistant color as specified herein.
  7. Comply with UL 510.
- K. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.
- L. Permitted Usage of Insulation Types:
  1. Type XHHW-2:
    - a. Building wire and power and control cable in architectural and non-architectural finished areas.

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- b. Building wire and power and control cable in conduit below grade.
- 2. Type THHN/THWN and THHN/THWN-2:
  - a. Building wire and power and control cable No. 8 AWG and smaller in architectural and non-architectural finished areas.
- 3. Type SIS and MTW:
  - a. For the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards, motor control centers.
- M. Conductor Size Limitations:
  - 1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
  - 2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.
  - 3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated on the Drawings.
- N. Building wire:

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V
Phase 1	Black	Brown
Phase 2	Red *	Orange
Phase 3	Blue	Yellow
Neutral	White	White or Gray
Ground	Green	Green

\* Orange when it is a high leg of a 120/240 V Delta system.

- a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
- b. Conductors larger than No. 6 AWG:
  - 1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:
    - a) Continuous colored outer finish along its entire length.
    - b) 3 IN of colored tape applied at the termination.
  - 2) Insulated grounding conductor shall be identified by one (1) of the following methods:
    - a) Continuous green outer finish along its entire length.
    - b) Stripping the insulation from the entire exposed length.
    - c) Using green tape to cover the entire exposed length.
  - 3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.
- 2. Power cables ICEA Method 4 with:
  - a. Phase and neutral conductors identified with 3 IN of colored tape, per the Table herein, applied at the terminations.
  - b. Ground conductor: Bare.
- 3. Control cables NEMA/ICEA Method 1, Table E-2:
  - a. When a bare ground is not provided, one (1) of the colored insulated conductors shall be re-identified by stripping the insulation from the entire exposed length or using green tape to cover the entire exposed length.
  - b. When used in power applications the colored insulated conductors used as phase and neutral conductors may have to be re-identified with 3 IN of colored tape, per the Table herein, applied at the terminations.
- O. Install all wiring in raceway unless otherwise indicated on the Drawings.
- P. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:

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1. Where specifically indicated on the Drawings.
  2. Where field conditions dictate and written permission is obtained from the Engineer.
  3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.
    - a. The combinations shall comply with the following:
      - 1) 12 Vdc, 24 Vdc and 48 Vdc may be combined.
      - 2) 125 Vdc shall be isolated from all other AC and DC circuits.
      - 3) AC control circuits shall be isolated from all DC circuits.
  4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted.
    - a. The combinations shall comply with the following:
      - 1) Analog signal circuits may be combined.
      - 2) Digital signal circuits may be combined but isolated from analog signal circuits.
  5. Multiple branch circuits for lighting, receptacle and other 120 Vac circuits are allowed to be combined into a common raceway.
    - a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NFPA 70, including but not limited to:
      - 1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
      - 2) {The neutral conductor may be shared on sequential circuits (e.g., circuit numbers 1,3,5) if multiple circuit breakers are provided.}{The neutral conductors may not be shared.}
      - 3) Up sizing raceway size for the size and quantity of conductors.
- Q. Ground the drain wire of shielded instrumentation cables at one (1) end only.
1. The preferred grounding location is at the load (e.g., control panel), not at the source (e.g., field mounted instrument).
- R. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
1. Feeder and branch power circuits:
    - a. Device outlet boxes:
      - 1) Twist/screw on type connectors.
    - b. Junction and pull boxes and wireways:
      - 1) Twist/screw on type connectors for use on No. 8 and smaller wire.
      - 2) Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.
    - c. Motor terminal boxes:
      - 1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
      - 2) Insulated mechanical screw type connectors for use on No. 8 AWG and larger wire.
    - d. Manholes or handholes:
      - 1) Twist/screw on type connectors pre-filled with epoxy for use on No. 8 AWG and smaller wire.
      - 2) Watertight compression or mechanical screw type connectors for use on No. 6 AWG and larger wire.
  2. Control circuits:
    - a. Junction and pull boxes: Terminal block type connector.
    - b. Manholes or handholes: Twist/screw on type connectors pre-filled with epoxy.
    - c. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.
  3. Instrumentation circuits can be spliced where field conditions dictate and written permission is obtained from the Engineer.
    - a. Maintain electrical continuity of the shield when splicing twisted shielded conductors.
    - b. Junction and pull boxes: Terminal block type connector.
    - c. Control panels and motor control centers: Terminal block or strip provided within

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- the equipment or field installed within the equipment by the Contractor.
4. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.
- S. Insulating Tape Usage:
1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
  2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
  3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.
- T. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. PVC coated rigid metallic conduits and repair kits:
    - a. Occidental Coating Company.
    - b. Perma-Cote.
    - c. Rob-Roy Ind.
    - d. Raychem "GelTek" tape.
  2. Rigid non-metallic conduit:
    - a. Carlon.
    - b. Cantex.
    - c. Osburn Associates.
  3. Flexible conduit:
    - a. AFC Cable Systems.
    - b. Anamet, Inc.
    - c. Electri-Flex.
    - d. Flexible Metal Hose Company.
    - e. International Metal Hose Company.
    - f. Triangle PWC Inc.
    - g. LTV Steel Company.
  4. Conduit fittings and accessories:
    - a. Appleton.
    - b. Carlon.
    - c. Cantex.
    - d. Crouse-Hinds.
    - e. Killark.
    - f. Osburn Associates.
    - g. OZ Gedney Company.
    - h. RACO.
    - i. Steel City.
    - j. Thomas and Betts.
  5. Support systems:
    - a. Unistrut Building Systems.
    - b. B-Line Systems Inc.
    - c. Kindorf.
    - d. Minerallac Fastening Systems.
    - e. Caddy.
  6. Outlet, pull and junction boxes:
    - a. Appleton Electric Co.
    - b. Crouse-Hinds.
    - c. Killark.
    - d. O-Z/Gedney.
    - e. Steel City.
    - f. Raco.
    - g. Bell.
    - h. Hoffman Engineering Co.
    - i. Wiegmann.
    - j. B-Line Circle AW.

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- k. Adalet.
- l. Rittal.
- U. PVC-Coated Rigid Steel Conduit (PVC-RGS):
  - 1. Nominal 40 mil Polyvinyl Chloride Exterior Coating:
    - a. Coating: Bonded to hot-dipped galvanized rigid steel conduit conforming to NEMA/ANSI C80.1.
    - b. The bond between the PVC coating and the conduit surface: Greater than the tensile strength of the coating.
  - 2. Nominal 2 mil, minimum, urethane interior coating.
  - 3. Urethane coating on threads.
  - 4. Conduit: Epoxy prime coated prior to application of PVC and urethane coatings.
  - 5. Female Ends:
    - a. Have a plastic sleeve extending a minimum of 1 pipe diameter or 2 IN, whichever is less beyond the opening.
    - b. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.
  - 6. Standards: NEMA/ANSI C80.1, UL 6, NEMA RN 1.
- V. Schedules 40 (PVC-40) and 80 (PVC-80):
  - 1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
  - 2. Rated for direct sunlight exposure.
  - 3. Fire retardant and low smoke emission.
  - 4. Shall be suitable for use with 90 DegC wire and shall be marked "maximum 90 DegC".
  - 5. Standards: NEMA TC 2, UL 651.
- W. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
  - 1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
  - 2. Extruded PVC outer jacket positively locked to the steel core.
  - 3. Liquid and vaportight.
  - 4. Standard: UL 360.
- X. Fittings for Use with PVC-RGS:
  - 1. General:
    - a. In hazardous locations listed for use in Class I, Groups C and D locations.
  - 2. Locknuts:
    - a. Threaded steel or malleable iron.
    - b. Gasketed or non-gasketed.
    - c. Grounding or non-grounding type.
  - 3. Bushings:
    - a. Threaded, insulated metallic.
    - b. Grounding or non-grounding type.
  - 4. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
  - 5. Couplings:
    - a. Threaded straight type: Same material and finish as the conduit with which they are used on.
    - b. Threadless type: Gland compression or self-threading type, concrete tight.
  - 6. Unions: Threaded galvanized steel or zinc plated malleable iron.
  - 7. Conduit bodies (ells and tees):
    - a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
    - b. Standard and mogul size.
    - c. Cover:
      - 1) Clip-on type with stainless steel screws.
      - 2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron or cast copper free aluminum.
- 8. Conduit bodies (round):
  - a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.

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- b. Cover: Threaded screw on type, gasketed, galvanized steel, zinc plated cast iron or cast copper free aluminum.
  - 9. Sealing fittings:
    - a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
    - b. Standard and mogul size.
    - c. With or without drain and breather.
    - d. Fiber and sealing compound: UL listed for use with the sealing fitting.
  - 10. Hazardous location flexible coupling (HAZ-FLEX):
    - a. Liquid tight and arc resistant.
    - b. Electrically conductive so no bonding jumper is required.
    - c. Dry and wet areas:
      - 1) Bronze braided covering over flexible brass core.
      - 2) Bronze end fittings.
      - 3) Zinc-plated steel or malleable iron unions and nipples.
    - d. Corrosive areas:
      - 1) Stainless steel braided covering over flexible stainless steel core.
      - 2) Stainless steel end fittings.
      - 3) Aluminum unions and nipples.
  - 11. Service entrance head:
    - a. Malleable iron, galvanized steel or copper free aluminum.
    - b. Insulated knockout cover for use with a variety of sizes and number of conductors.
  - 12. Expansion couplings:
    - a. 2 IN nominal straight-line conduit movement in either direction.
    - b. Galvanized steel with insulated bushing.
    - c. Gasketed for wet locations.
    - d. Internally or externally grounded.
  - 13. Expansion/deflection couplings:
    - a. 3/4 IN nominal straight-line conduit movement in either direction.
    - b. 30-degree nominal deflection from the normal in all directions.
    - c. Metallic hubs, neoprene outer jacket and stainless steel jacket clamps.
    - d. Internally or externally grounded.
    - e. Watertight, raintight and concrete tight.
  - 14. Standards: UL 467, UL 514B, UL 886. Y.
- Fittings for Use with FLEX-LT :
- 1. Connector:
    - a. Straight or angle type.
    - b. Metal construction, insulated and gasketed.
    - c. Composed of locknut, grounding ferrule and gland compression nut.
    - d. Liquid tight.
  - 2. Standards: UL 467, UL 514B.
- Z. Fittings for Use with Rigid Non-Metallic PVC Conduit:
- 1. Coupling, adapters and conduit bodies:
    - a. Same material, thickness, and construction as the conduits with which they are used.
    - b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
    - c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
  - 2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
  - 3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B. AA.

### Weather and Corrosion Protection Tape:

- 1. PVC based tape, 10 mils thick.
- 2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
- 3. Used with appropriate pipe primer.



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### BB. NEMA 4X Rated (metallic):

1. Body and cover: 14 GA Type 316 stainless steel.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Hinged door and stainless steel screws and clamps.
6. Door with oil-resistant gasket.

### CC. Miscellaneous Accessories:

1. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
2. Split covers when heavier than 25 LBS.
3. Weldnuts for mounting optional panels and terminal kits.
4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.

### DD. Standards: NEMA 250, UL 50.

### EE. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:

1. Material requirements.
  - a. Galvanized steel: ASTM A123 or ASTM A153.
  - b. Stainless steel: AISI Type 316.
  - c. PVC coat galvanized steel: ASTM A123 or ASTM A153 and 20 mil PVC coating.

### FF. Single Conduit and Outlet Box Support Fasteners:

1. Material requirements:
  - a. Zinc plated steel.
  - b. Stainless steel.
  - c. Malleable iron.
  - d. PVC coat malleable iron or steel: 20 mil PVC coating.
  - e. Steel protected with zinc phosphate and oil finish.

### GG. Sleeves, smoke and fire stop fitting through walls and floors:

1. See Specification Section 01800.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install and wire all equipment, including prepurchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.
  - B. Install equipment in accordance with the requirements of:
    1. NFPA 70.
    2. IEEE C2.
    3. The manufacturer's instructions.
  - C. In general, conduit routing is not shown on the Drawings.
    1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
    2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.
  - D. When complete branch circuiting is not shown on the Drawings:
    1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.
2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
  3. The indicated home run conduit and conductor size shall be used for the entire branch

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- circuit.
- 4. See Specification Section 16120 for combining multiple branch circuits in a common conduit.
- E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.
- F. Install equipment plumb, square and true with construction features and securely fastened.
- G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process, gas, air and water piping and equipment.
- H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operating and maintenance requirements of other equipment.
- I. Device Mounting Schedule:
  - 1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
    - a. Light switch (to center): 48 IN.
    - b. Receptacle in architecturally finished areas (to center): 18 IN.
    - c. Receptacle on exterior wall of building (to center): 18 IN.
    - d. Receptacle in non-architecturally finished areas (to center): 48 IN.
    - e. Telephone outlet in architecturally finished areas (to center): 18 IN.
    - f. Telephone outlet for wall-mounted phone (to center): 54 IN.
    - g. Safety switch (to center of operating handle): 54 IN.
    - h. Separately mounted motor starter (to center of operating handle): 54 IN.
    - i. Pushbutton or selector switch control station (to center): 48 IN.
    - j. Panelboard (to top): 72 IN.
- J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.
  - 1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may {make adjustments of up to 6 IN in equipment location with the Engineer's approval.} {make adjustments in equipment locations in accordance with the following without obtaining the Engineer's approval:}
    - a. 1 FT at grade, floor and roof level in any direction in the horizontal plane.
    - b. {{1 FT on walls in a horizontal direction within the vertical plane.
    - c. Changes in equipment location exceeding those defined above require the Engineer's approval.
- K. Provide electrical equipment support system per the following area designations:
  - 1. Dry areas:
    - a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
    - b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
  - 2. Wet areas:
    - a. PVC coated steel system consisting of PVC coated steel channels and fittings with stainless steel nuts and hardware.
  - 3. Corrosive areas:
    - a. PVC coated steel system consisting of PVC coated steel channels and fittings with stainless steel nuts and hardware.
  - 4. Highly corrosive areas:
    - a. PVC coated steel system consisting of PVC coated steel channels and fittings with stainless steel nuts and hardware.
- L. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
  - 1. Do not cut, or weld to, building structural members.

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2. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.
- M. Provide corrosion resistant spacers to maintain 1/4 IN separation between metallic equipment and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters, Reservoirs, etc.
- N. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.
- O. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.
- P. Do not use materials that may cause the walls or roof of a building to discolor or rust.
- Q. Identify electrical equipment and components in accordance with Specification Section 10400.

### 3.2 FIELD QUALITY CONTROL

- A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.
- B. Replace equipment and systems found inoperative or defective and re-test.
- C. The protective coating integrity of support structures and equipment enclosures shall be maintained.
  1. Repair galvanized components utilizing a zinc rich paint.
  2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
  3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the component.
  4. Repair surfaces which will be inaccessible after installation prior to installation.
- D. Replace nameplates damaged during installation.

### END OF SECTION

## **SECTION 16060 GROUNDING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Material and installation requirements for grounding system(s).

#### **1.2 QUALITY ASSURANCE**

- A. Referenced Standards:
  - 1. ASTM International (ASTM):
    - a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
  - 2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - a. 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.
  - 3. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC).
      - 1) Article 250, Grounding and Bonding.
      - 2) Article 610, Cranes and Hoists.
      - 3) Article 620, Elevators, Dumbwaiters, Escalators, Moving Walks, Platform Lifts, and Stairway Chairlifts.
  - 4. Underwriters Laboratories, Inc. (UL):
    - a. 467, Grounding and Bonding Equipment.
- B. Assure ground continuity is continuous throughout the entire Project.

#### **1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
  - 2. Product technical data.
    - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
      - 1) Grounding clamps, terminals and connectors.
      - 2) Exothermic welding system.
    - b. See Specification Section 16010 for additional requirements.

### **PART 2 - PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  - 1. Ground rods and bars and grounding clamps, connectors and terminals:
    - a. Burndy.
    - b. Harger Lightning Protection.
    - c. Heary Brothers.
    - d. Joslyn.
    - e. Robbins Lightning Protection.
    - f. Thomas & Betts (Blackburn).
    - g. Thompson.
  - 2. Exothermic weld connections:
    - a. Erico Products Inc., Cadweld.
    - b. Harger Lightning Protection.

## ADDENDUM 2

- c. Thermoweld.
- 3. Prefabricated composite test stations:
  - a. Quazite Composolite.
  - b. Armorcast Products Company.

### 2.2 COMPONENTS

- A. Wire and Cable:
  - 1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
  - 2. Insulated conductors: Color coded green, per Specification Section 16120.
- B. Ground Bars:
  - 1. Solid copper:
    - a. 1/4 IN thick.
    - b. 2 or 4 IN wide.
    - c. 24 IN long minimum in main service entrance electrical rooms, 12 IN long elsewhere.
  - 2. Predrilled grounding lug mounting holes.
  - 3. Stainless steel or galvanized steel mounting brackets.
  - 4. Insulated standoffs.
- C. Ground Rods:
  - 1. 3/4 IN x 10 FT.
  - 2. Copperclad:
    - a. Heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
    - b. Corrosion resistant bond between the copper and steel.
    - c. Hard drawn for a scar-resistant surface.
- D. Grounding Clamps, Connectors and Terminals:
  - 1. Mechanical type:
    - a. Standards: UL 467.
    - b. High copper alloy content.
  - 2. Compression type for interior locations:
    - a. Standards: UL 467.
    - b. High copper alloy content.
    - c. Non-reversible.
    - d. Terminals for connection to bus bars shall have two bolt holes.
  - 3. Compression type suitable for direct burial in earth or concrete:
    - a. Standards: UL 467, IEEE 837.
    - b. High copper alloy content.
    - c. Non-reversible.
- E. Exothermic Weld Connections:
  - 1. Copper oxide reduction by aluminum process.
  - 2. Molds properly sized for each application.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
  - 1. Install products in accordance with manufacturer's instructions.
  - 2. Size grounding conductors and bonding jumpers in accordance with NFPA 70, Article 250, except where larger sizes are indicated on the Drawings.
  - 3. Remove paint, rust, or other nonconducting material from contact surfaces before making ground connections.
  - 4. Where ground conductors pass through floor slabs or building walls provide non-metallic sleeves and install per Specification Section 01800.
  - 5. Do not splice grounding conductors except at ground rods.
  - 6. Install ground rods and grounding conductors in undisturbed, firm soil.
    - a. Provide excavation required for installation of ground rods and ground conductors.

## ADDENDUM 2

- b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
  - c. Unless otherwise specified, connect conductors to ground rods with compressor type connectors or exothermic weld.
  - d. Provide sufficient slack in grounding conductor to prevent conductor breakage during backfill or due to ground movement.
  - e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
- 7. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.
- B. Grounding Electrode System:
  - 1. Provide a grounding electrode system in accordance with NFPA 70, Article 250 and as indicated on the Drawings.
  - 2. Grounding conductor terminations:
    - a. Ground bars mounted on wall, use compression type terminal and bolt it to the ground bar with two bolts.
    - b. Ground bars in electrical equipment, use compression type terminal and bolt it to the ground bar.
    - c. Piping systems use mechanical type connections.
    - d. Building steel, below grade and encased in concrete, use compression type connector or exothermic weld.
    - e. At all above grade terminations, the conductors shall be labeled per Specification Section 10400.
  - 3. Ground ring grounding system:
    - a. Ground ring consists of ground rods and a grounding conductor looped around the structure.
    - b. Placed at a minimum of 10 FT from the structure foundation and 2 FT-6 IN below grade.
    - c. Provide a minimum of four (4) ground rods placed at the corners of the structure and additional rods so that the maximum distance between ground rods does not exceed 50 FT.
    - d. Building/Structure grounding:
      - 1) Bond building/structure metal support columns to the ground ring at all corners of the structure.
    - e. Grounding conductor: Bare conductor, size as indicated on the Drawings.
- C. Supplemental Grounding Electrode:
  - 1. Provide the following grounding in addition to the equipment ground conductor supplied with the feeder conductors whether or not shown on the Drawings.
  - 2. Equipment support rack and pedestals mounted outdoors:
    - a. Connect metallic structure to a ground rod.
    - b. Grounding conductor: #6 AWG minimum.
- D. Raceway Bonding/Grounding:
  - 1. All metallic conduit shall be installed so that it is electrically continuous.
  - 2. All conduits to contain a grounding conductor with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
  - 3. NFPA 70 required grounding bushings shall be of the insulating type.
  - 4. Provide double locknuts at all panels.
  - 5. Bond all conduit, at entrance and exit of equipment, to the equipment ground bus or lug.
  - 6. Provide bonding jumpers if conduits are installed in concentric knockouts.
  - 7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.
- E. Equipment Grounding:
  - 1. All utilization equipment shall be grounded with an equipment ground conductor.

## ADDENDUM 2

### F. Manhole and Handhole Grounding:

1. Provide a ground rod and ground bar, when indicated or as needed, in each manhole and handhole with exposed metal parts.
  - a. Expose a minimum of 4 IN of the rod above the floor for field connections to the rod.
2. Connect all exposed metal parts (e.g., conduits and cable racks) to the ground rod.

### 3.2 FIELD QUALITY CONTROL

- A. Leave grounding system uncovered until observed by Owner.

**END OF SECTION**

**SECTION 13200**  
**WELDED STEEL MIX/STORAGE TANK**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. This Specification applies to the fabrication and installation of a steel mix/storage tank. Contractor shall furnish a steel tank fabricated in a shop, including coating, deliver, and install the plant on site. Contractor responsibility includes:
1. Design, fabrication, erection, inspection and testing of a welded steel water storage tank in accordance with API 650 latest edition with all appurtenances, braces and structural members. Tank shall include a conical section, 2 feet deep, at the tank bottom and an extension of the tank sidewall of 3 feet to contain the conical section. The bottom of the conical section shall be 1 foot above the tank support slab and shall be provided with a 6 inch outlet for tank drainage.
- B. This specification does not apply to the following items:
1. Site grading and earthwork for a tank site.
  2. Corrosion protection for a tank.
  3. Disinfection of the tank.

**1.02 ABBREVIATIONS**

AC	Alternating current
ACI	American Concrete Institute
API	American Petroleum Institute
ASTM	American Society Testing Materials
AWWA	American Water Works Association
CAL/OSHA	Cal OSHA
DC	Direct current
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NMWD	North Marin Water District
SSPC	Steel Structures Painting Council
UBC	Uniform Building Code

**1.03 REFERENCED CODES AND STANDARDS**

- A. Unless otherwise specified herein or shown on the drawings, work under this Specification shall be performed in accordance with the following codes and standards in force on the date of award of the Contract to which this Specification is a part thereof:
1. API 650 Welded Steel tanks for Oil Storage.
  2. CAL/OSHA Title 8, Construction Safety Orders.

**1.04 TANK and TANK FOUNDATION DESIGN**

- A. Contractor shall provide structural calculation and construction drawings for the tank and



## ADDENDUM 2

the underlying concrete slab and soil foundation. Calculations and foundations shall be prepared by and stamped by a registered civil or structural engineer.

- B. Roof shall have a slope of 2-inch per foot. The roof shall be supported so that it does not bow under its design dead loads or allow ponding of water.
- C. Tank, concrete slab, and foundation design shall be coordinated into a single structural D
- D. Structural calculations and construction drawings shall serve as the basis for obtaining a building permit to construct the tank. In addition the calculations and drawings shall be submitted to the Engineer for review and approval.

### 1.05. DESIGN

#### A. Criteria:

Operating capacity	20,000 gallons <sup>1</sup>
Diameter	13 feet-8 inches minimum
Roof load	25 psf
Wind velocity	100 mph
Exposure	C
Important factor $I_w$	1.25
Lowest, one-day mean ambient temperature	35 degree Fahrenheit
Allowable bearing pressure	3,000 psf <sup>2</sup>
$C_a$	0.65
$S_s$ , mapped maximum spectral response acceleration parameter, 1 second	2.008
$S_1$ , mapped maximum spectral response acceleration parameter, 0.2 second	0.784
$F_a$ , acceleration based site coefficient	1.0
$F_v$ , velocity based site coefficient	1.5
$R_{wl}$ , force reduction factor	4
$R_{wc}$ , force reduction coefficient	2
Project location	Lat: 37° 38' 2.67"; Long: 122° 07' 48.5"
1-below tank overflow	

2- this value may be increased by 33% to include wind or seismic loads

### 1.06 SUBMITTALS AND APPROVALS

#### A. Working Drawings

- 1. Upon award of the Contract, the Contractor shall submit, as soon as practical, two sets of reproducible drawings and calculations for approval by the Engineer, which shall include:
  - a. Complete engineering and design computations for the tank, appurtenances and tank foundation, including seismic computations.
  - b. Structural steel cutting and fabrication plans.
  - c. Complete shop and field erection drawings with details showing the location,

## ADDENDUM 2

size, shape, thickness and grade of all structural components, including accessories and appurtenances.

- d. Welding procedures and details.
- e. Catalog cuts, including descriptions of standard manufactured items.
- B. The Contractor shall allow at least one week for submitted drawings to be in the possession of the Engineer for correction or approval.
  - 1. The Engineer shall return one of the two sets showing changes or approval. If the drawings are not approved, they shall be corrected and resubmitted promptly.
- C. Any change shall be made on any drawing only after it has been approved by the Engineer, except at the Engineer's direction.
- D. Changes made necessary by field conditions shall be submitted for approval.
- E. The Contractor shall purchase materials and equipment and begin fabrication required under the Contract only after the drawings have been approved by the Engineer.
- F. The Contractor must furnish an affidavit of compliance stating that the work and materials furnished meet the requirements of this Specification.
- G. Certified copies of mill test reports for all structural steel components shall be submitted to the Engineer.
- H. If field welding is required for changes to the drawings or because the tank fails to meet these specifications then the Contractor shall provide the Engineer with welder qualifications two full working days before the welder is to begin work. The Engineer shall reserve the right to approve or reject any welders.

### Part 2 PRODUCTS

#### 2.01 GENERAL

- A. Unless otherwise specified, materials and construction shall conform to API 650. Steel plates shall conform to ASTM A36 and structural shapes shall conform to ASTM A36. Submerged bolts shall be Type 304 stainless steel and all other bolts shall be galvanized or zinc coated.

#### 2.02 SHELL

- A. Shell plates shall be cold rolled to the tank radius prior to the removal of mill scale.
- B. Horizontal and vertical joints shall be butt welded on each side with full penetration.
- C. If structural bracing of the shell is required, these members shall only be placed on the inside of the shell.
- D. Shell plates shall include all vertical plates.

#### 2.03 ACCESSORIES

- A. Shell manholes
  - 1. Shell manholes shall be 24 inches in diameter and shall be hinged to the shell and have a D-shaped flush type cleanout reinforcement doubler design.

## ADDENDUM 2

### B. Pipe connections

1. Pipe connections shall be provided as per API 650.
2. Penetrations of shell not be less than 12 inches clear above bottom.
3. Inlet and outlet nozzles shall be sized for clear inside diameters.
4. Nozzles shall be designed to support line-sized flanged AWWA C504 butterfly valves.

### C. Overflow

1. The tank shall have an overflow as specified on the drawings.

### D. External ladder

1. Exterior ladder
  - a. the tank shall have one exterior ladder meeting the requirements of API 650. Exterior ladder shall be accessible from the tank base and shall extend to the tank top and allow hand support for roof access.
  - b. The exterior ladder shall be provided with a Saf-T-Pivot dismount section as manufactured by North Safety Products or equal and shall conform to the requirements of OSHA climbing safety regulations
  - c. The exterior ladder shall be constructed ASTM A36 steel.

### E. Roof hatch

1. Provide steel hinges and a locking hasp
2. The hatch opening shall have a 4-inch high curb and the hatch cover shall lap the curb by 2 inches.
3. The roof hatch shall be located over the interior ladder.
4. Shell manholes shall be 24 inches in diameter and shall be hinged to the shell and have a D-shaped flush type cleanout reinforcement doubler design.

### F. Vent

1. Provide a 6" nozzle at the roof center for venting foul gasses.

### G. Fibrous Pad.

1. To ensure uniform bearing of the tank on the concrete foundation, a non-combustible, flexible, fibrous pad shall be inserted between the tank bottom and the foundation surface, covering the entire portion of the foundation under the tank base.
2. The fibrous pad shall conform to ASTM D1751

### H. Girders, rafters, and columns shall be designed of standard structural steel shapes or open web beams fabricated from standard structural steel shapes.

## 2.04. WELDED CONNECTIONS

### A. All fabrication shall be joined by welding and no corrosion allowance need be provided to

## ADDENDUM 2

any parts.

- B. Shell plate joints shall have complete penetration butt welds.
- C. Butt welds subject to secondary stress shall be complete penetration butt welds.

### **PART 3 EXECUTION**

#### **3.01 CONSTRUCTION**

- A. General
  - 1. Construction shall conform to API 650.
- B. Welding
  - 1. All welding shall comply with API 650.
  - 2. Contractor certified qualification records of the welders employed for erection shall be reviewed by the Engineer at the start of erection and each time a new welder is employed. If the tank is assembled and welded at a manufacturer's plant, qualification records of the welders shall be provided to the Engineer prior to tank delivery.

#### **3.02 HYDROTESTING**

- A. Upon completion of tank fabrication work the storage tank shall be hydro tested.
  - 1. Fill the tank with water to the overflow level. Water shall be furnished by the Owner at no cost to the Contractor. Additional water for retests will be at the Contractor's expense and shall be charged at the current rate in effect in accordance with City regulations.
  - 2. Once the reservoir is completely filled, it shall sit for a period of 24 hours. If no leaks are present, the tank has satisfactorily passed the hydrotest.
  - 3. If leaks are present, repairs shall be made by welding at no additional cost to the District.

#### **3.03 Electrical**

- A. The Contractor shall install all electrical equipment to provide a complete system ready for operation at the tank site and as indicated on the District Plans. Electrical work shall be in accordance with the NEC.
  - 1. Conduit, conduit supports and accessories shall be hot-dipped galvanized.
  - 2. All switch, outlet and junction boxes as required by code or convenience shall be deep-cast type with threaded conduit hubs as required for exterior service.
  - 3. Burrs and sharp edges shall be removed.
  - 4. Conduits shall be free of foreign matter and shall be cleaned as necessary prior to pulling wire.
  - 5. Sufficient length shall be left at ends of wires to make connections conveniently to equipment and devices.
  - 6. Terminal lugs shall be solderless-type ring terminal lugs.

## ADDENDUM 2

7. Equipment enclosures shall be NEMA 3.

### 3.04 TANK COATING

- A. The following or approved equal coating materials shall be used on the interior and exterior surfaces of the tank, including nozzles, access ladder, safety railing and other appurtenances welded to the tank:

	Product	Coating thickness	Application
INTERIOR	Sherwin Williams Phenicon HS	5-6 mils, DFT	1 coat
	Sherwin Williams Phenicon HS FF	5-6 mils, DFT	1 coat
EXTERIOR	Sherwin Williams Macropoxy HS	6 mils DFT, minimum	1 coat
	Sherwin Williams Acrolon 218 Polyurethane	6 mils DFT, minimum	1 coat

- B. Surface Preparation.

1. Remove all oil and grease from surface by solvent cleaning per SSPC-SP1.
2. Minimum surface preparation is Near White Metal Blast Cleaning per SSPC-SP10/NACE 2.
3. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2mils/50microns).
4. Remove all weld spatter and round all sharp edges.
5. Prime any bare steel the same day as it is cleaned or before flash rusting occurs.

END OF SECTION

## **SECTION 11385 PUMPS**

### **PART 1--GENERAL**

#### **1.01 DESCRIPTION**

##### **A. SCOPE:**

1. This section specifies positive displacement type pumps, complete with electric motors and all specified appurtenances, mounted on a common baseplate.

##### **B. TYPE:**

1. The pumping units shall be of specifically designed for pumping wastewater treatment sludges containing organic solids and small inorganic particles.

##### **C. PERFORMANCE REQUIREMENTS**

1. Equipment shall be designed and selected for continuous duty pumping of concentrated solids derived from the treatment of wastewater. Pumps shall be suitable for exposure to primary sludge, mixed primary and waste secondary sludge, and mixed thickened sludge containing grit, small particles of wood, metal, industrial solvents, greases, detergents, petroleum products, and organic particles in concentrations as great as 12 percent. The pumped fluids are expected to range in temperatures between 60 degrees F and 100 degrees F, and the pH may vary between 4 and 9.
2. Where indicated, the equipment including drive train, shall be designed for operation at variable speed.
3. Each pump, along with associated drive appurtenances, shall be mounted on a common fabricated steel baseplate. The baseplate shall be either stainless steel or hot dip galvanized carbon steel after fabrication.

#### **1.02 QUALITY ASSURANCE**

##### **A. REFERENCES:**

1. This section contains references to the documents listed below. They are a part of this section as specified and modified. Where a referenced document cites other standards, such standards are included as references under this section as if

referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, has been discontinued or has been replaced.

Reference	Title
ASTM A470	Vacuum-Treated Carbon and Alloy Steel Forgings for Turbine Rotors and Shafts
ASTM A536	Ductile Iron Castings

#### B. SHIPMENT, PROTECTION, AND STORAGE:

1. Equipment shipment, protection, and storage shall conform to the manufacturer's written requirements and Section 01605.

#### 1.4 ENVIRONMENTAL CONDITIONS

1. Pumps to be provided under this section will be located outdoors in a weather exposed area.

### PART 2--PRODUCTS

#### 2.01 MANUFACTURERS

1. City requires the following manufacturer to provide the equipment and/or products to be furnished under this section. City believes the manufacturer is capable of producing equipment and/or products that will satisfy the requirements of this section. This statement, however, shall not be construed to mean that the named manufacturer's standard product will comply with the requirements of this section.

## 2.02 EQUIPMENT

### A. Required Brand and Model

1. Contractor to provide the following pumps. Equals will not be considered due to standardization policy at the project site.

<u>Application</u>	<u>Manufacturer</u>	<u>Performance</u>	<u>Motor Size</u>
Mix Pump	Vaughan PE3F6	150 gpm at 20.3 ft TDH	5.0 HP
Injection Pump	Penn Valley 4DDSX30	0-140 gpm at 40 ft TDH	AFD 7.5 HP

### B. MOTOR AND DRIVE UNIT:

1. Reference Section 16220, Motors.

### C. BASE:

1. Pump base and support shall be rigidly mounted. Pumps and drive assemblies shall be supported on common base pads or pedestals, as specified.

## 2.03 PRODUCT DATA

### A. The following product data shall be provided in accordance with Section 01300:

1. Applicable operating and maintenance information.
2. Catalog information for all components, materials list, and additional information describing the conformance of the proposed equipment with design and operating requirements of this section.

## PART 3--EXECUTION

### 3.01 INSTALLATION

- A. Each pumping unit shall be aligned, connected, and installed at the locations specified and in accordance with manufacturer's written recommendations. The pumping units shall be installed and tested under the direction of factory-trained personnel.
- B. After completion of installation, each pumping unit shall be completely field tested to demonstrate compliance with the performance requirements as specified.
- C. Testing procedures shall duplicate as nearly as possible the conditions of operation and shall be selected to demonstrate that the equipment is operational and free from damage. Each control device, item or mechanical, electrical, and instrumentation equipment, and control circuits shall be considered in the testing procedures to



## ADDENDUM 2

demonstrate that the equipment has been properly serviced, aligned, connected, calibrated, and adjusted prior to operation.

END OF SECTION

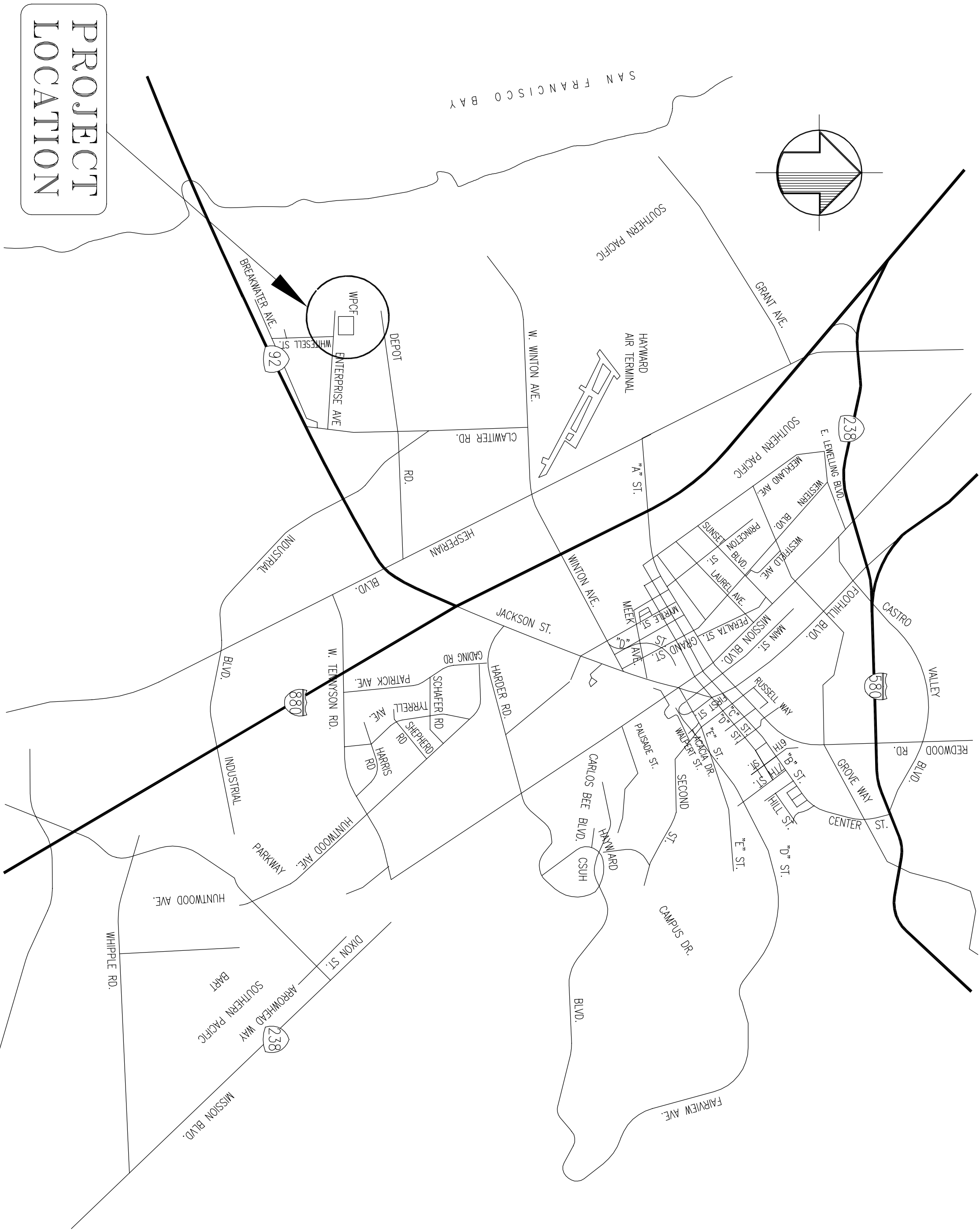
CITY OF HAYWARD  
ALAMEDA COUNTY, CALIFORNIA  
PLANS

WPCF GREASE RECEIVING AND PROCESSING FACILITY

Revised Per  
Addendum #2

PROJECT NO. 613-7511  
FILE NO. E-2002  
DATE: FEBRUARY 2012

AT THE TIME THIS CONTRACT IS AWARDED, THE CONTRACTOR SHALL POSSESS A CLASS "A" LICENSE.

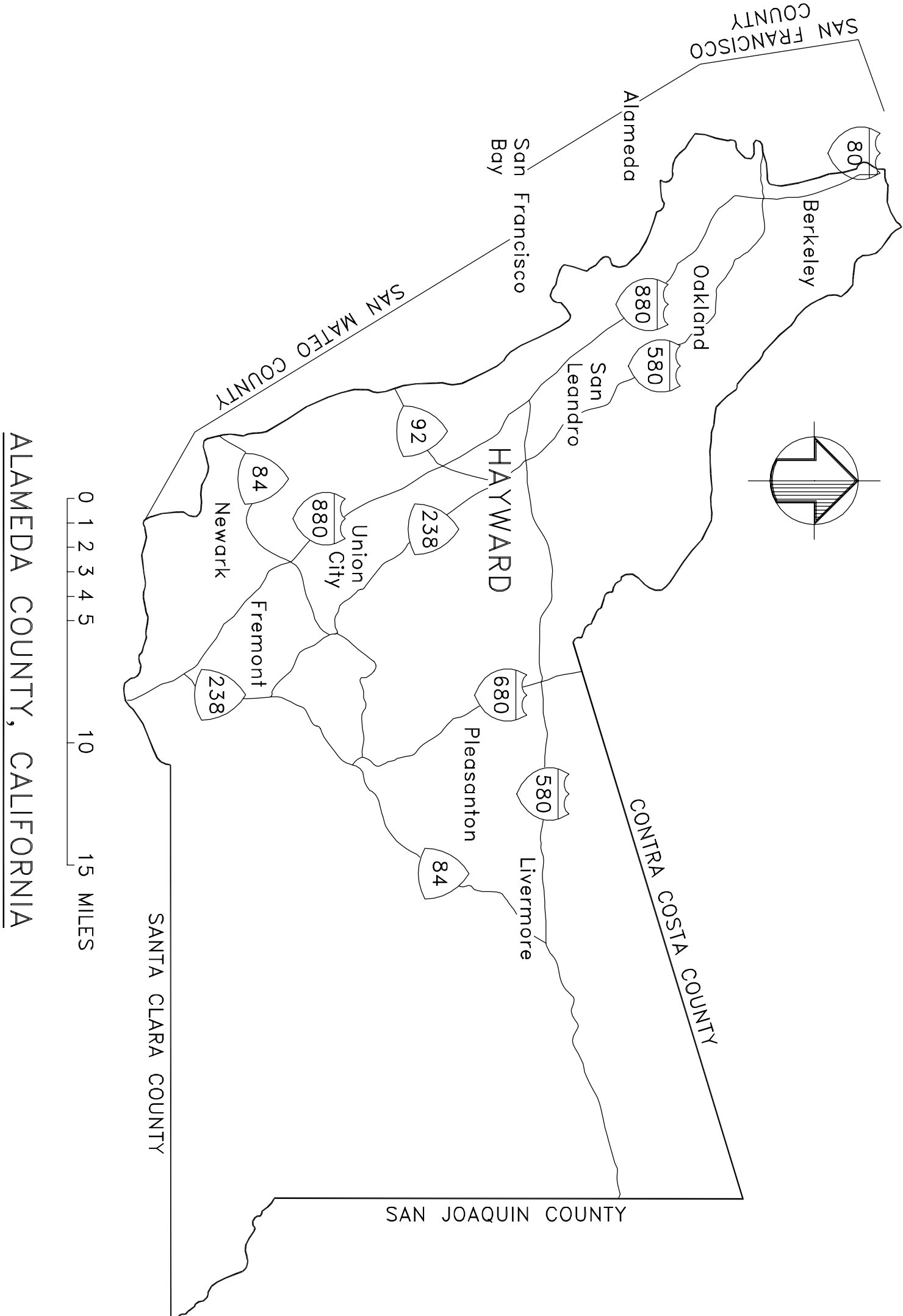


PROJECT  
LOCATION

LOCATION MAP

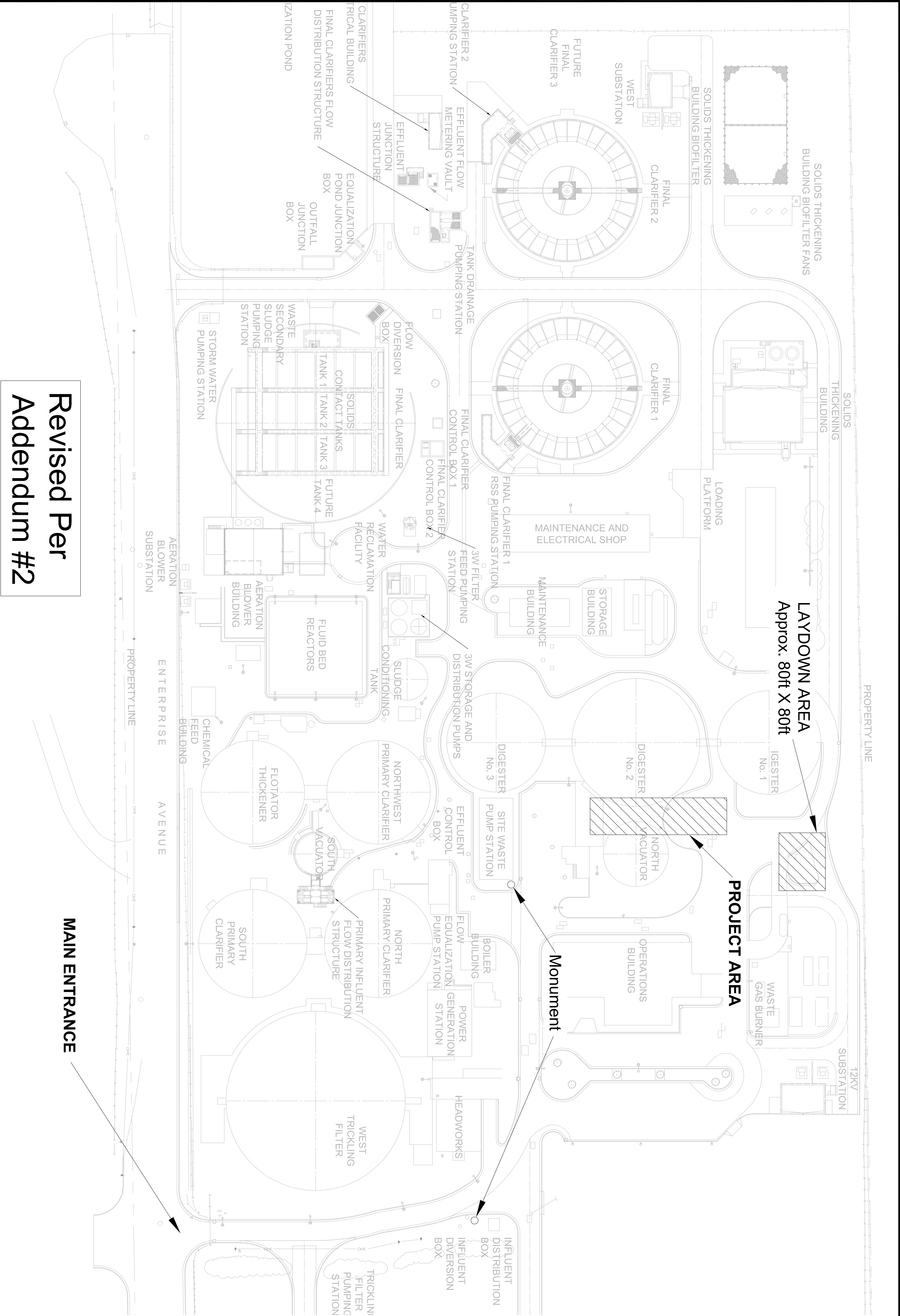
INDEX OF SHEETS

SHEET NO.	TITLE
1	Title Sheet
2	WPCF Project Area Layout
3	Overall Plan View
4	Plan View 2
5	Plan View 1 and 3
6	Process Schematic Plan
7	Tank and Tank Pad Detail
8	Injection & Grinder-Receiving Lines
9	Injection Line
10	North Vacuator Scum Line
11	Sludge Waste Line
12	Support Details
13	Pipe Trench & Containment Structure Details
13A	Site Elevation Points
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16	Transfer Pump Control Diagram
17	Mixing Pump Control Diagram
18	Electrical Site Power Plan
19	Electrical Details I
20	Electrical Details II
21	P&ID Symbols legend
22	P&ID Grease System



ALEX AMERI  
DIRECTOR OF PUBLIC WORKS – PUBLIC UTILITIES & ENVIRONMENTAL SERVICES  
RCE NO. 40155  
REGISTRATION EXPIRES 9-30-2012

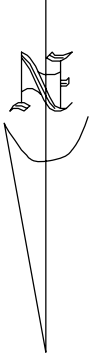
MORAD FAKHRAI  
DIRECTOR OF PUBLIC WORKS – ENGINEERING & TRANSPORTATION/CITY ENGINEER  
RCE NO. 43921  
REGISTRATION EXPIRES 6-30-2013



Revised Per  
Addendum #2

CITY OF HAYWARD DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION				WPCF Grease Receiving and Processing Facility	
DESIGNED BY: DLG				CHECKED BY: GS	
DRAWN BY: TL				APPROVAL, REC'D: HL	
APPROVED BY:				APPROVED BY:	
ALEX AMERI PUBLIC WORKS DIRECTOR-UTILITIES				WISAD TAKHRAI, PUBLIC WORKS DIRECTOR ENGINEERING & TRANSPORTATION/CITY ENGINEER	
PROJ. NO.: 7511				DATE: FEB 2012	
REV.	DATE	DESCRIPTION	BY	SCALE: None	TOTAL SHEETS: 23 FILE NO.: E-2002
					SHEET NO. 2

- Notes:
1. Contractor is responsible to perform the field verification of all existing utilities prior to any construction.
  2. The Contractor shall contact "USA North" at 1-800-227-2600 or 811 (toll free) at least 10 days prior to construction and 48 hours prior to any excavation.



# Revised Per Addendum #2

DIGESTER 1

DIGESTER 2

NORTH VACUATOR  
EQUIPMENT ROOM

NORTH VACUATOR

DIGESTER 1 PUMP ROOM

27" SS  
MANHOLE

NORTH VACUATOR  
LINE METER

ABANDONED GAS LINE FOR SCUM DETAIL'S  
6" NORTH VACUATOR SCUM DETAIL'S  
SEE SHEET 10

PLAN VIEW MATCH  
LINE-SOUTH

PLAN VIEW MATCH LINE-NORTH

8" SEWER PIPE @ 1/2% MIN SLOPE

PROVIDE 45° WYE W/PLUG  
FOR FUTURE CONNECTION

SEE DETAIL ON SHEET 13  
FOR CONNECTION

PLAN VIEW 1  
(See Sheet 5)

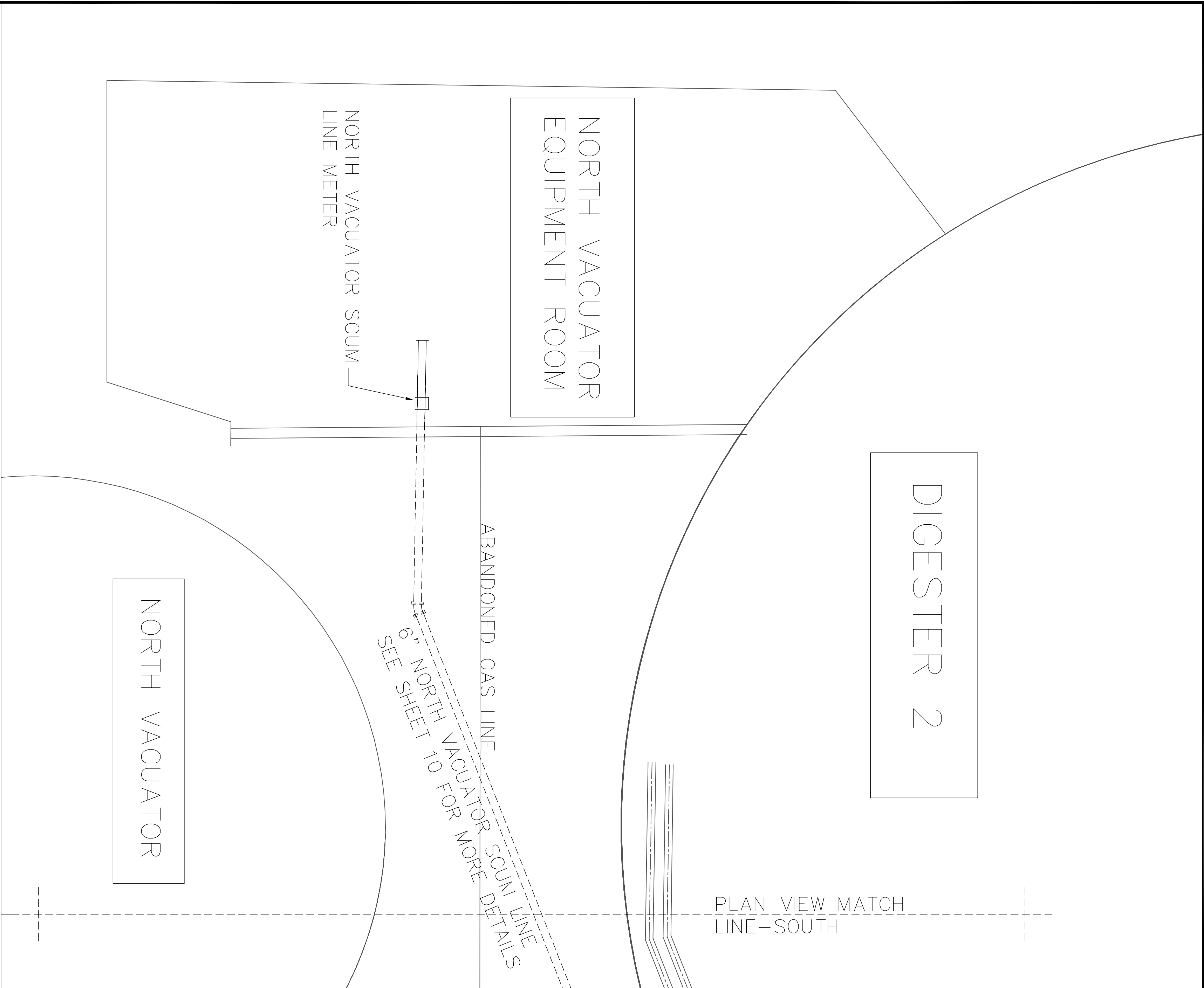
PLAN VIEW 2  
(See Sheet 4)

PLAN VIEW 3  
(See Sheet 5)

CITY OF HAYWARD DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION				WPCF Grease Receiving and Processing Facility	
DESIGNED BY: DLC				CHECKED BY: GS	
DRAWN BY: DLC				APPROVAL REC'D: HL	
APPROVED BY:				APPROVED BY:	
ALEX AMERI PUBLIC WORKS DIRECTOR-UTILITIES				MORAD TAKHRAI, PUBLIC WORKS DIRECTOR ENGINEERING & TRANSPORTATION/CITY ENGINEER	
PROJ. NO.: 7511				DATE: FEB 2012	
REV.	DATE	DESCRIPTION	BY	SCALE: None	TOTAL SHEETS: 23 FILE NO.: E-2002
					SHEET NO. 3

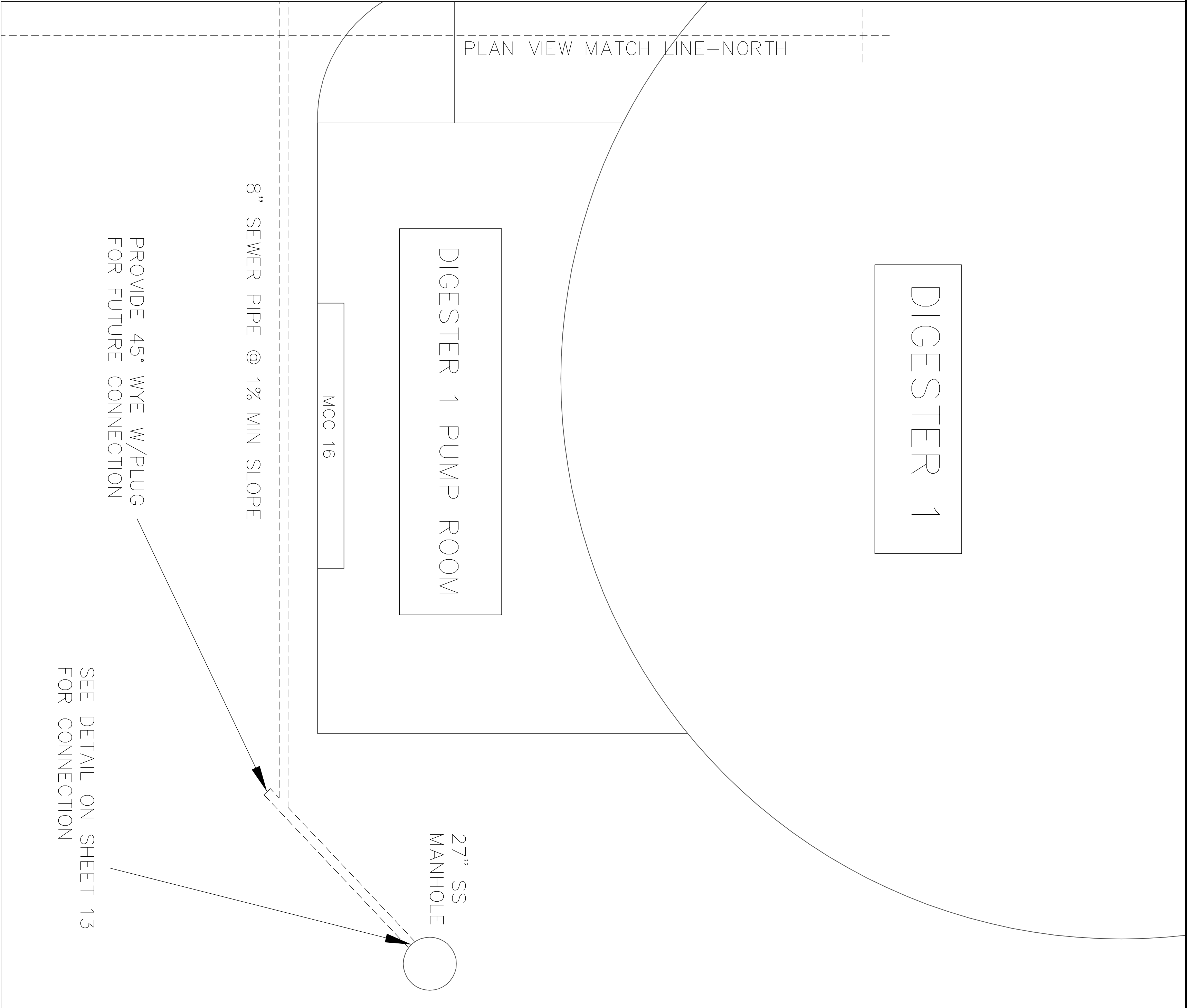






PLAN VIEW 1  
Scale 1"=5'

Revised Per  
Addendum #2



PLAN VIEW 3  
Scale 1"=5'

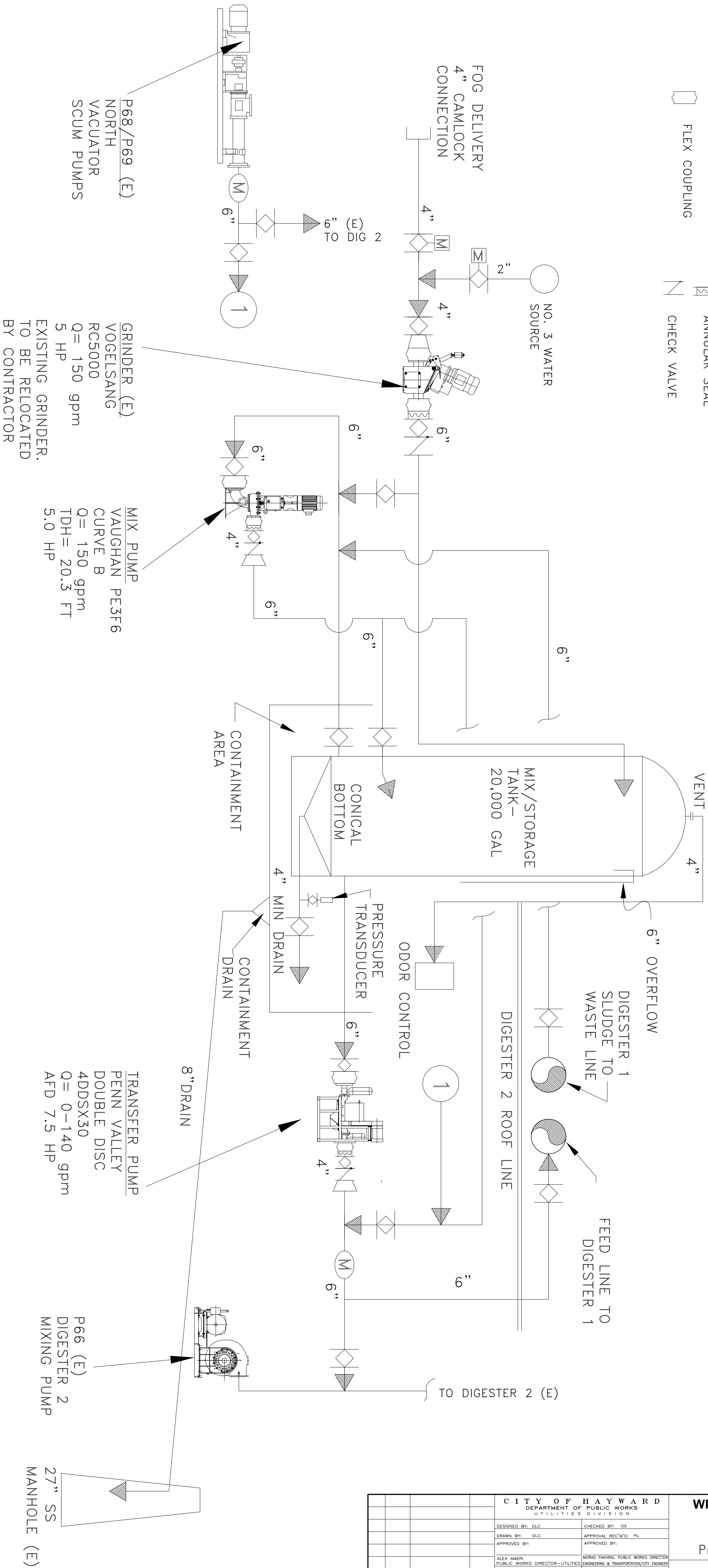
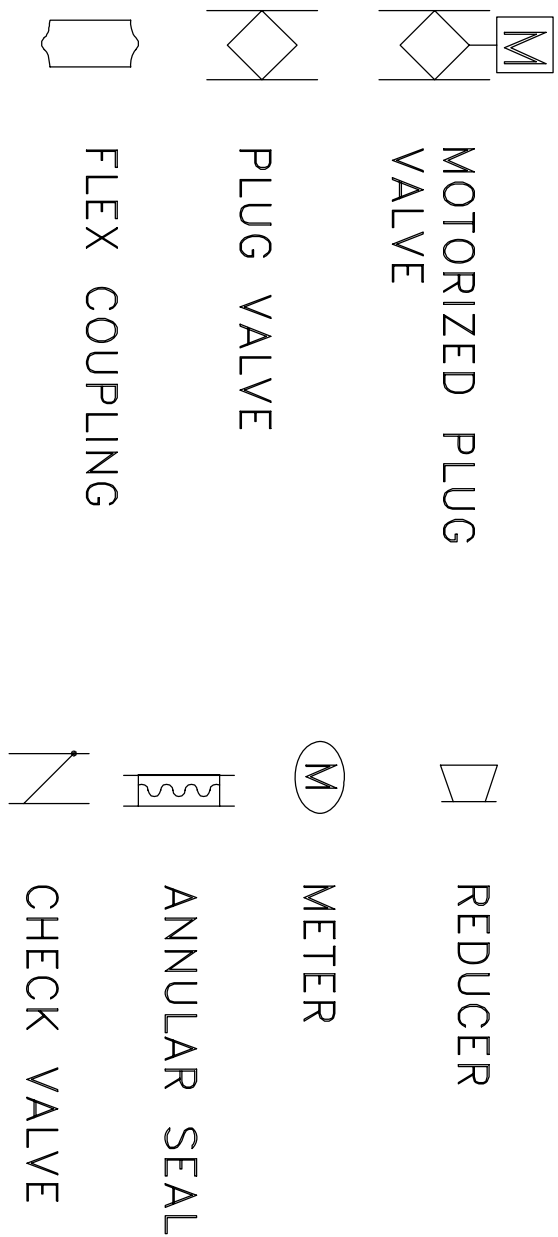
PROVIDE 45° WYE W/PLUG  
FOR FUTURE CONNECTION

SEE DETAIL ON SHEET 13  
FOR CONNECTION

CITY OF HAYWARD DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION				WPCF Grease Receiving and Processing Facility	
DESIGNED BY: DLC				CHECKED BY: GS	
DRAWN BY: DLC				APPROVAL REC'D: HL	
APPROVED BY:				APPROVED BY:	
ALEX AMERI PUBLIC WORKS DIRECTOR-UTILITIES				MORAD TAKHRAI, PUBLIC WORKS DIRECTOR ENGINEERING & TRANSPORTATION/CITY ENGINEER	
PROJ. NO.: 7511				DATE: FEB 2012	
REV.	DATE	DESCRIPTION	BY	SCALE: AS SHOWN	TOTAL SHEETS: 23 FILE NO.: E-2002
					SHEET NO. 5

VERIFY SCALE  
BAR IS ONE INCH ON  
ORIGINAL DRAWING  
0 1"  
IF NOT ONE INCH ON  
THIS SHEET, ADJUST  
SCALE ACCORDINGLY

SYMBOLS LEGEND

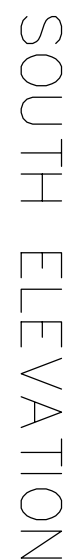
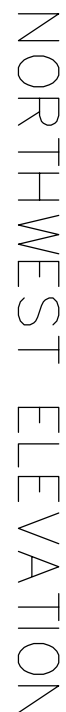
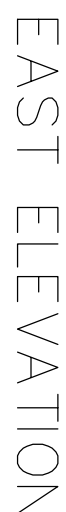


Revised Per  
Addendum #2


PROCESS SCHEMATIC PLAN  
NOT TO SCALE

CITY OF HAYWARD DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION				WPCF Grease Receiving and Processing Facility	
DESIGNED BY: DLC		CHECKED BY: GS		Process Schematic Plan	
DRAWN BY: DLC		APPROVAL REC'D: HL		SCALE: None	TOTAL SHEETS: 23
APPROVED BY:		APPROVED BY:		FILE NO.: E-2002	SHEET NO. 6
ALEX AMER PUBLIC WORKS DIRECTOR-UTILITIES		MORAD FAKHRAL, PUBLIC WORKS DIRECTOR ENGINEERING & TRANSPORTATION/CITY ENGINEER			
PROJ. NO.: 7511		DATE: FEB 2012			
REV.	DATE	DESCRIPTION	BY		

NOTE: ACCESS SAFETY CONTAINMENT NOT SHOWN IN THIS VIEW



VERIFY SCALE  
BAR IS ONE INCH ON  
ORIGINAL DRAWING

0  1"

IF NOT ONE INCH ON  
THIS SHEET, ADJUST  
SCALE ACCORDINGLY

	CONTAINMENT WALL TOP EL 18.50
	CONTAINMENT WALL TOP EL 19.00

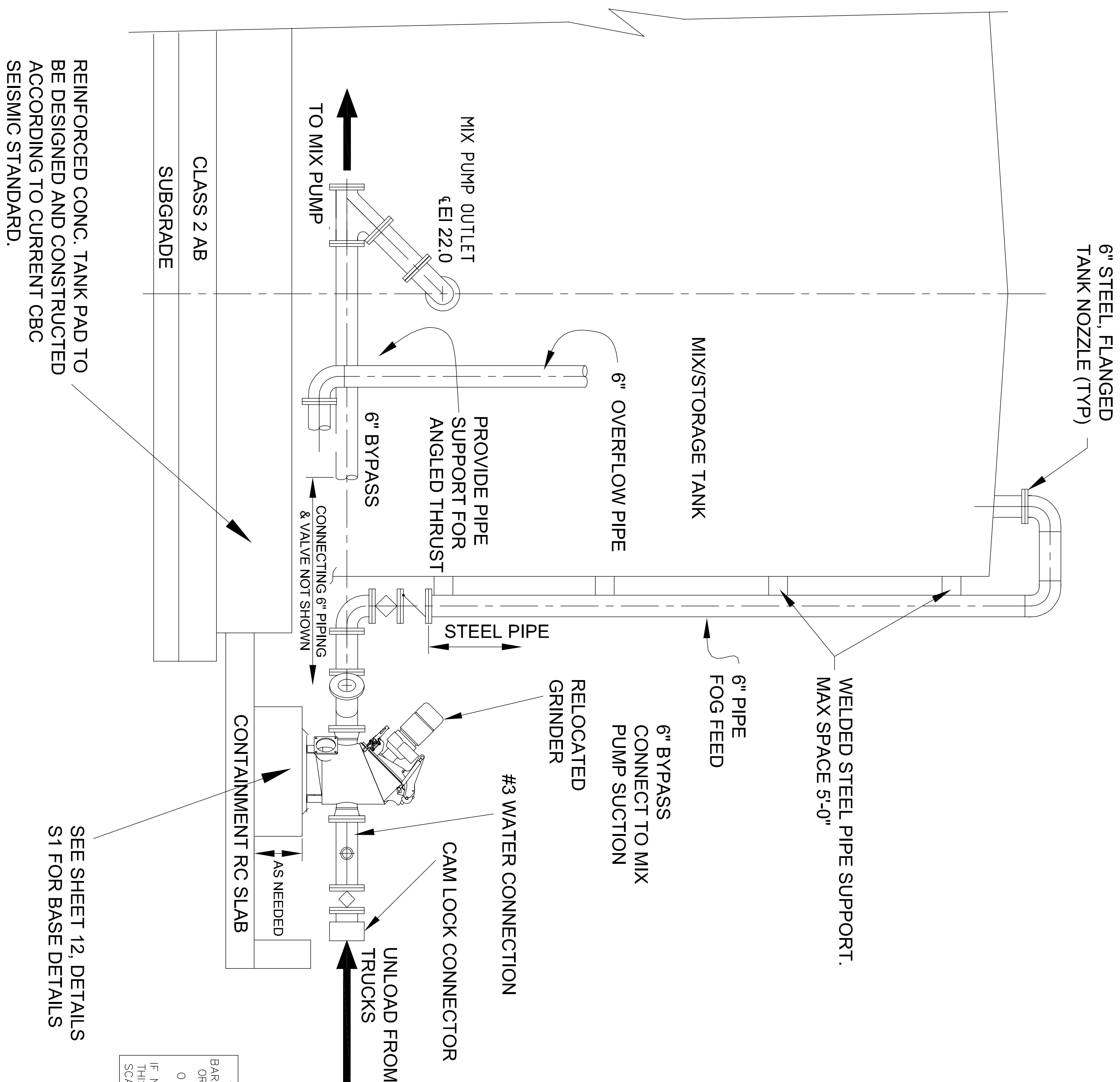
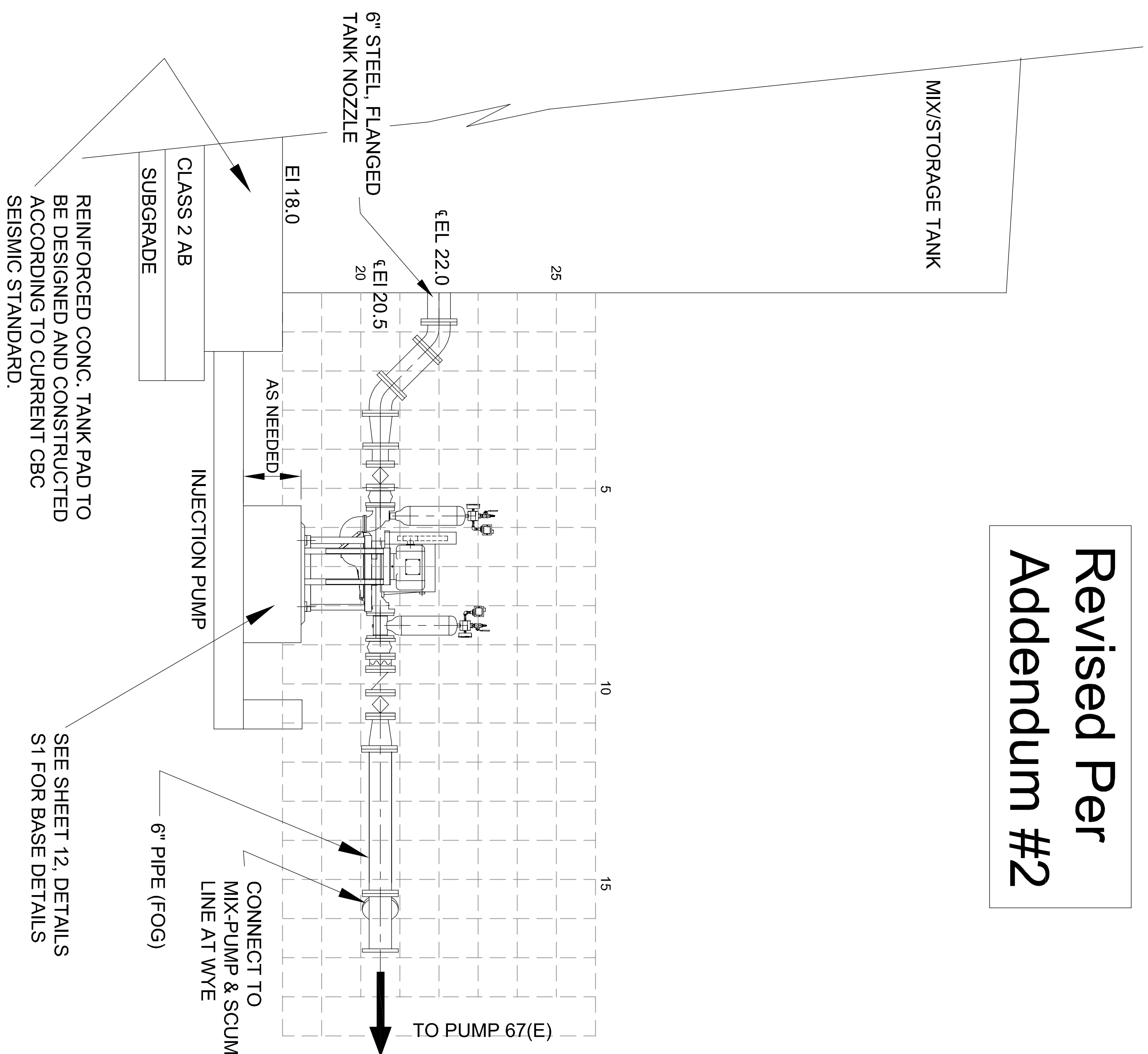
6. See Sheet 2 for monument locations. City will provide benchmark information to Contractor.

## WPCF Grease Receiving and Processing Facility

## Tank and Tank Pad Detail



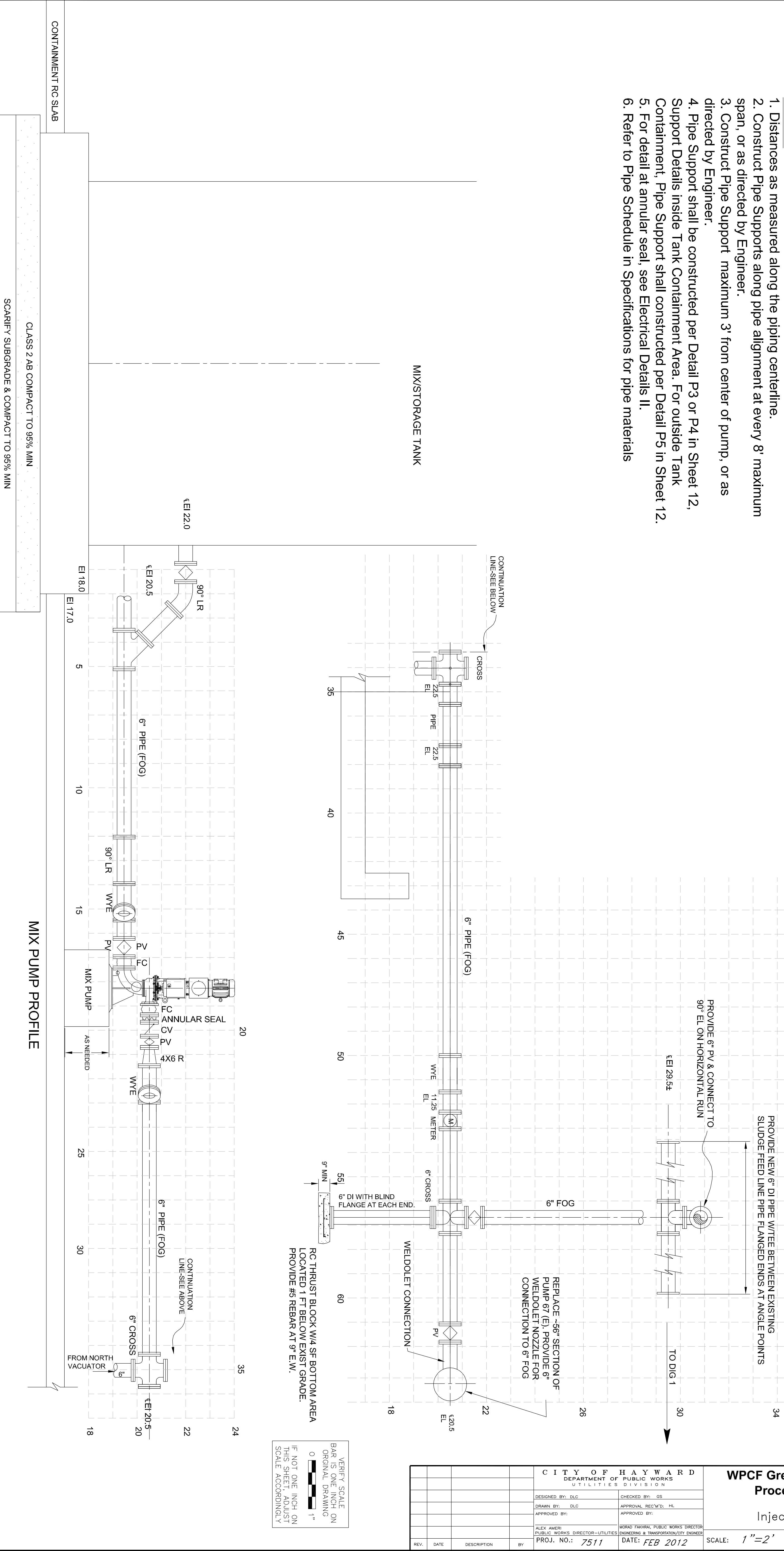
# Revised Per Addendum #2

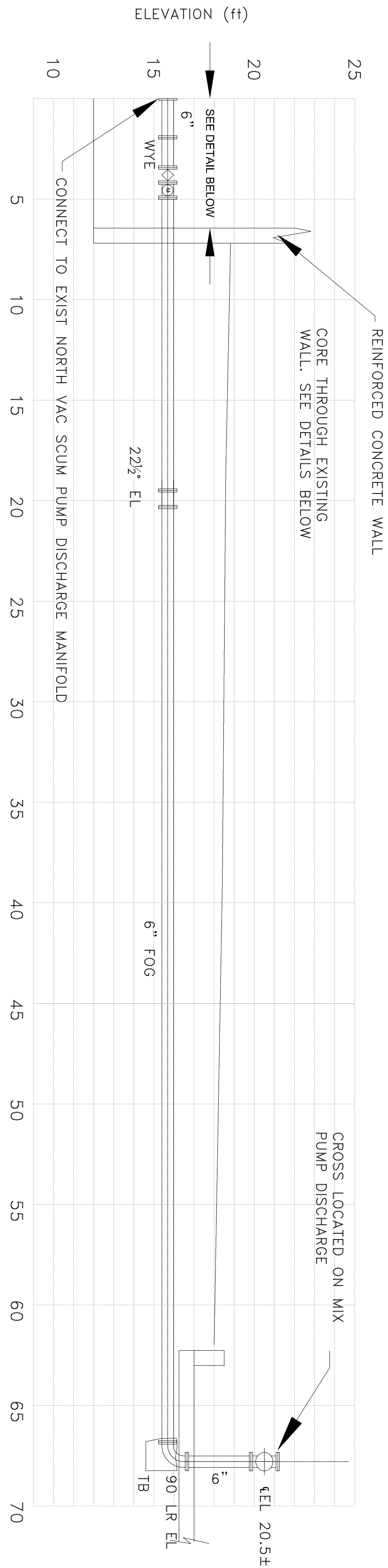


		<p align="center"><b>CITY OF HAYWARD</b> DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION</p> <p>DESIGNED BY: DLZ      CHECKED BY: DS DRAWN BY: DLG      APPROVAL RECORD: HL APPROVED BY: _____</p> <p>ALEX AMERI, PUBLIC WORKS DIRECTOR—UTILITIES MORAN TASHIRO, PUBLIC WORKS DIRECTOR ENGINEERING &amp; TRANSPORTATION CITY ENGINEER</p>		<p align="center"><b>WPCF Grease Receiving and Processing Facility</b>  Injection &amp; Grinder-Receiving Lines</p>		
REV.	DATE	DESCRIPTION	BY	SCALE: AS SHOWN	<p>TOTAL SHEETS: 23 FILE NO.: E-2002-</p>	SHEET NO. 8

Revised Per  
Addendum #2

- NOTES:
1. Distances as measured along the piping centerline.
  2. Construct Pipe Supports along pipe alignment at every 8' maximum span, or as directed by Engineer.
  3. Construct Pipe Support maximum 3' from center of pump, or as directed by Engineer.
  4. Pipe Support shall be constructed per Detail P3 or P4 in Sheet 12, Support Details inside Tank Containment Area. For outside Tank Containment, Pipe Support shall constructed per Detail P5 in Sheet 12.
  5. For detail at annular seal, see Electrical Details II.
  6. Refer to Pipe Schedule in Specifications for pipe materials

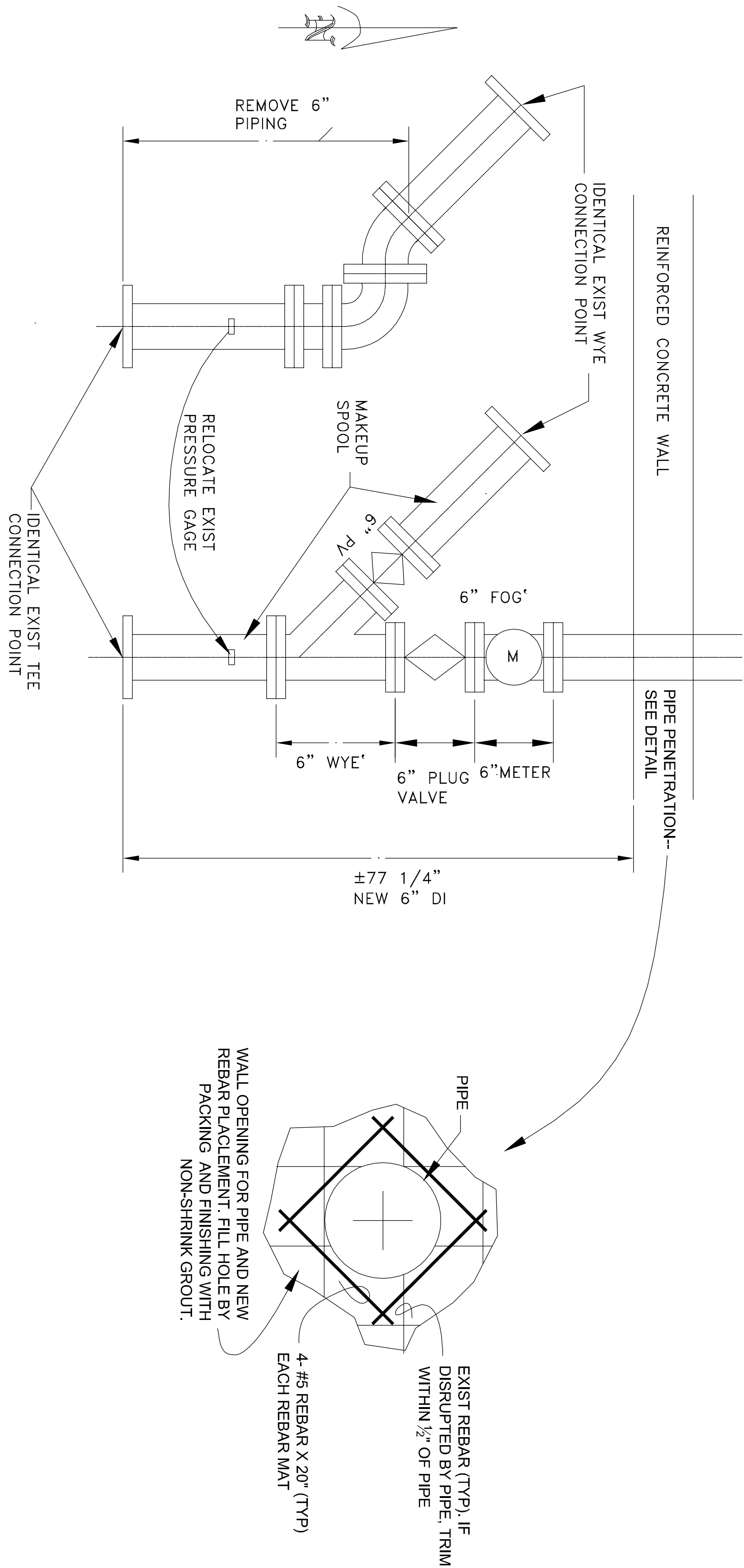




NORTH VACUATOR SCUM LINE

Scale: 1"=3'

Revised Per  
Addendum #2

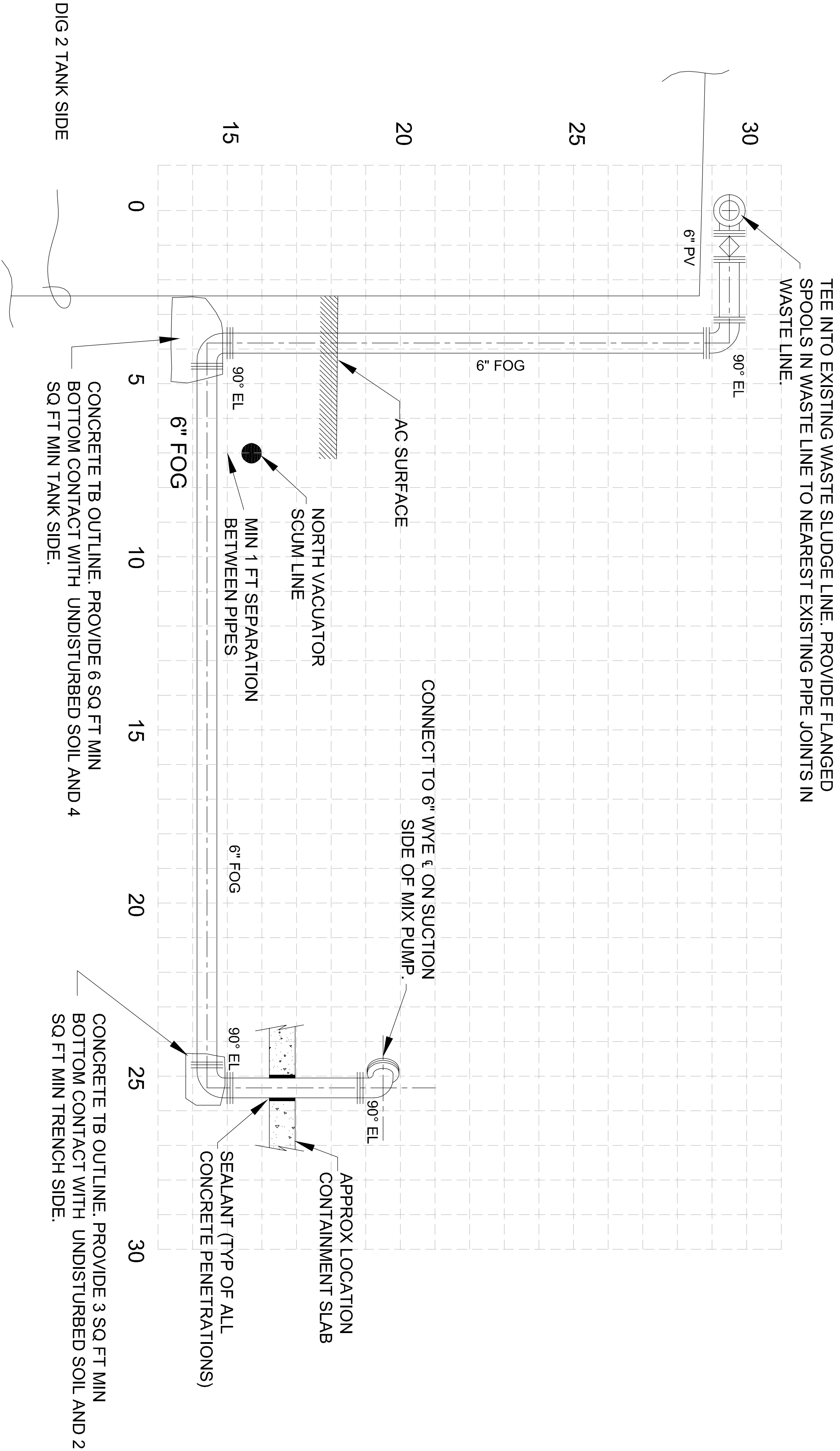


SCUM LINE CONNECTION DETAIL

No Scale

CITY OF HAYWARD DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION				WPCF Grease Receiving and Processing Facility	
DESIGNED BY: DUC	CHECKED BY: GS	North Vavuator Scum Line		SCALE: 1"=3'	TOTAL SHEETS: 23
DRAWN BY: DUC	APPROVAL REC'D: HL				FILE NO.: E-2002
APPROVED BY:	APPROVED BY:				SHEET NO. 10
ALEX AMERI PUBLIC WORKS DIRECTOR--UTILITIES	MORAD FARHAT, PUBLIC WORKS DIRECTOR ENGINEERING & TRANSPORTATION DIVISION				
PROJ. NO.: 7511	DATE: FEB 2012				
REV.	DATE	DESCRIPTION	BY		

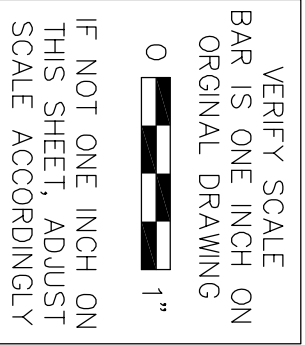
NOTE:  
HORIZONTAL DISTANCES ARE ALONG  
PIPING € (TYP ALL PROFILES).



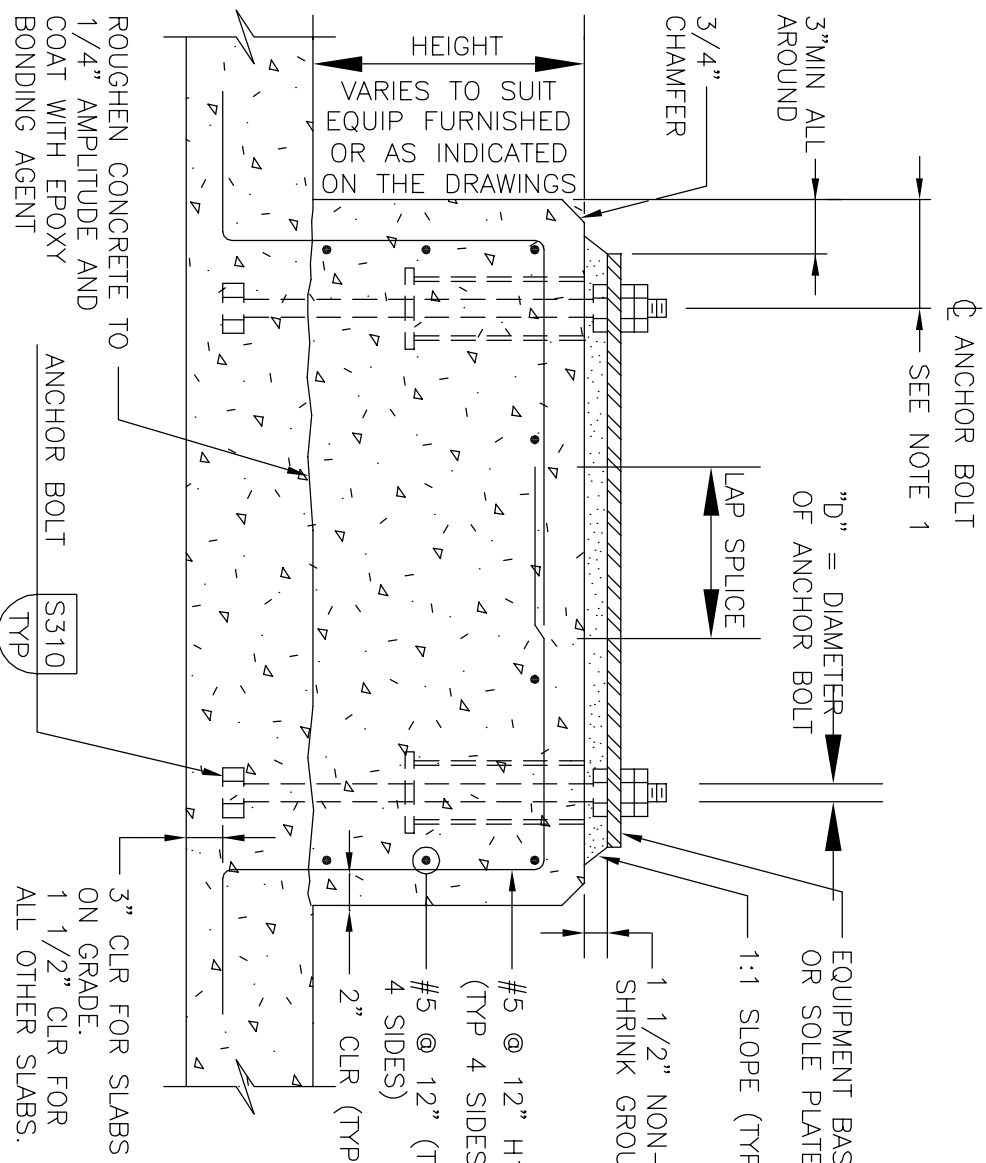
Revised Per  
Addendum #2

WASTE SLUDGE LINE PROFILE

1" = 2'



CITY OF HAYWARD DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION				WPCF Grease Receiving and Processing Facility		
DESIGNED BY: DLC		CHECKED BY: GS		Sludge Waste Line		
DRAWN BY: DLC		APPROVAL REC'D: HL				
APPROVED BY:		APPROVED BY:				
ALEX AMERI PUBLIC WORKS DIRECTOR-UTILITIES		MORAD FAKHRAL, PUBLIC WORKS DIRECTOR ENGINEERING & TRANSPORTATION/CITY ENGINEER				
REV.	DATE	DESCRIPTION	BY	PROJ. NO.: 7511	DATE: FEB 2012	SCALE: AS SHOWN
				TOTAL SHEETS: 23	FILE NO.: E-2002	SHEET NO. 11



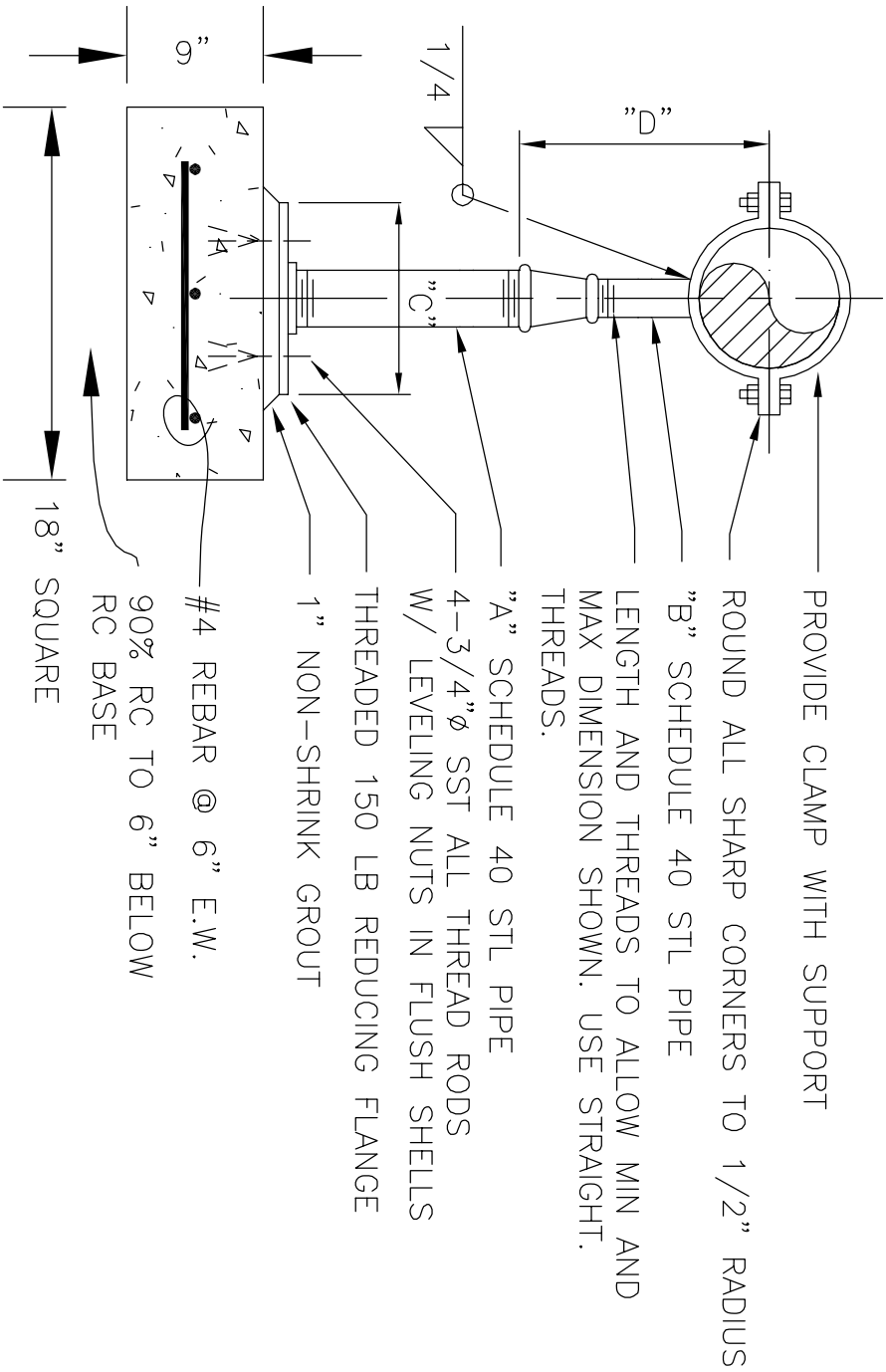
- NOTE:
1. THE EDGE DISTANCE ON THE ANCHOR BOLTS SHALL NOT BE LESS THAN 6" OR 8 x "D".

S1 EQUIPMENT BASE  
TYP

## Revised Per Addendum #2

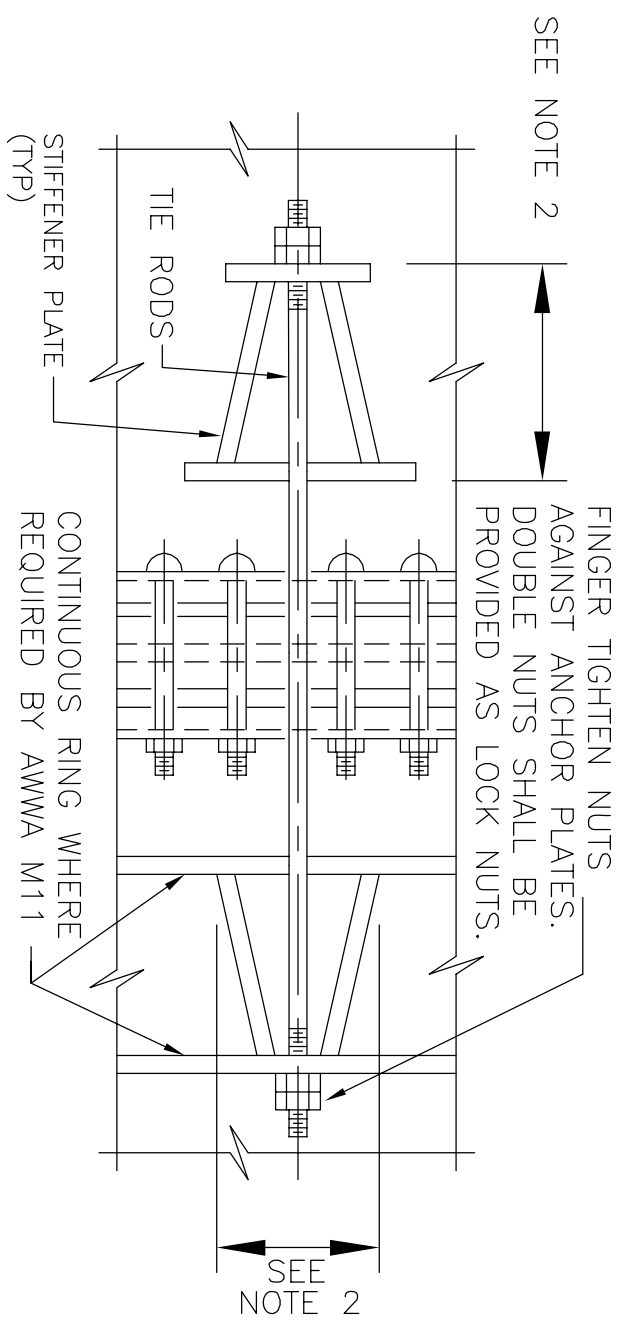
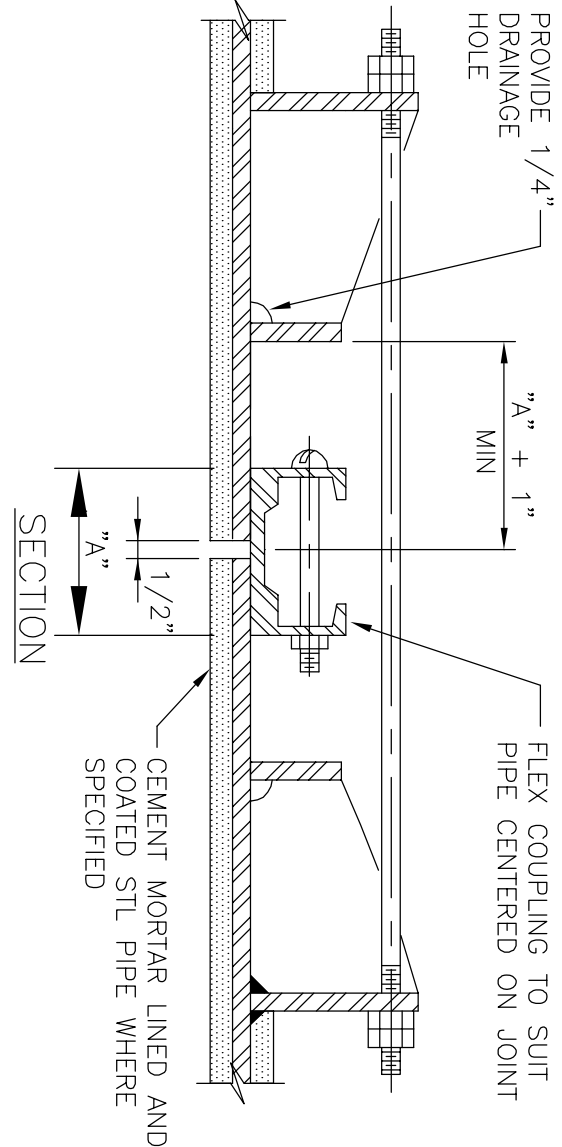
ADJUSTABLE PIPE SADDLE SUPPORT SCHEDULE				
DIMENSIONS IN INCHES				
SIZE OF SUPPORTED PIPE	PIPE SIZE "A"	PIPE SIZE "B"	"C"	"D" MINIMUM MAXIMUM
* 2 1/2	2 1/2	1 1/2	9	8 13
3	2 1/2	1 1/2	9	8 1/2 13 1/2
3 1/2	2 1/2	1 1/2	9	8 1/2 13 1/2
4	3	2 1/2	9	9 1/2 14
6	3	2 1/2	9	10 1/2 15 1/2
8	3	2 1/2	9	11 1/2 16 1/2
10	3	2 1/2	9	13 1/2 18 1/2
12	3	2 1/2	9	15 19 1/2

\* USE 2 1/2" SUPPORTS FOR PIPES LESS THAN 2 1/2"



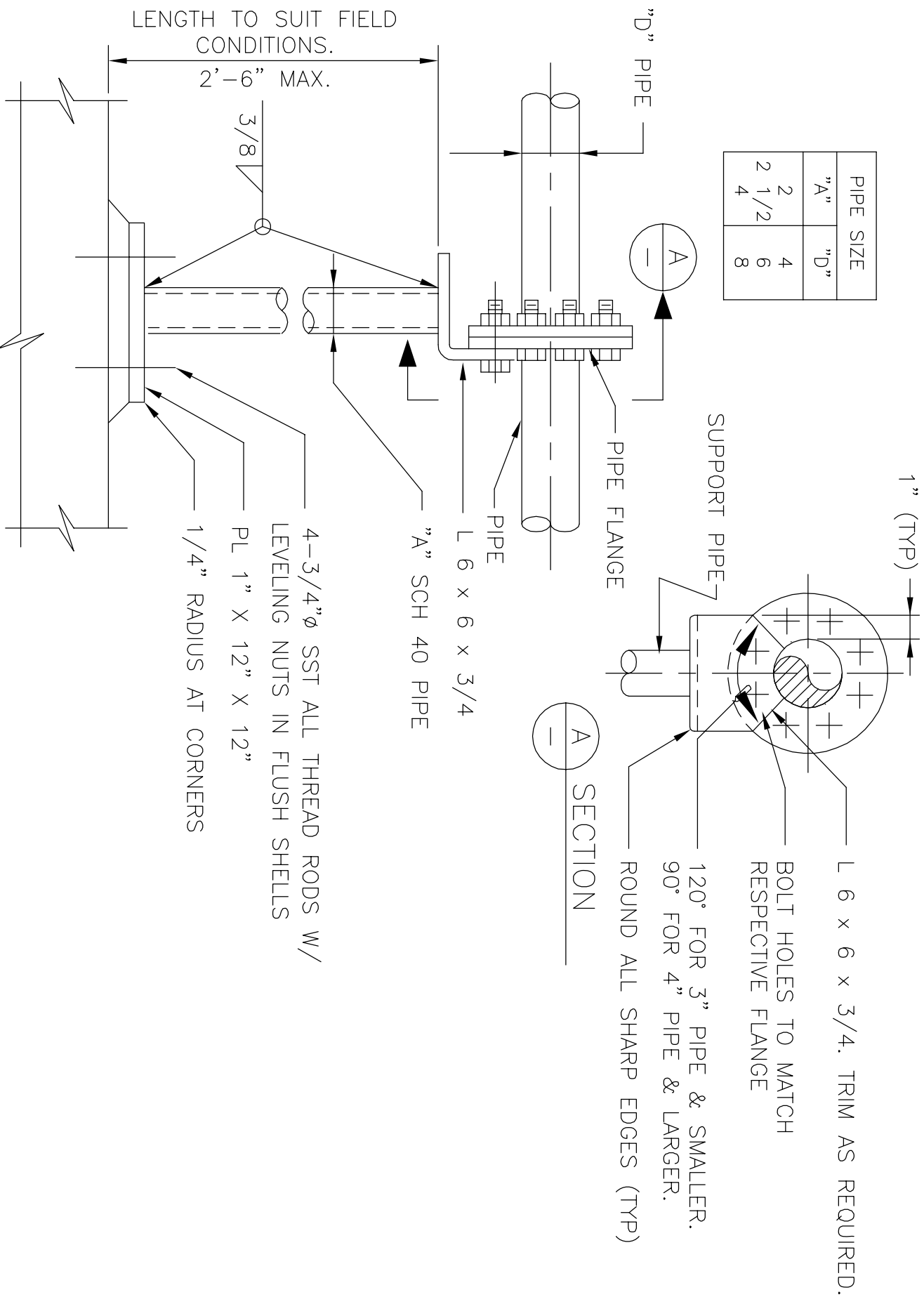
P3 ADJUSTABLE PIPE SUPPORT  
TYP

- NOTE:
1. HOT-DIP GALVANIZE AFTER FABRICATION.



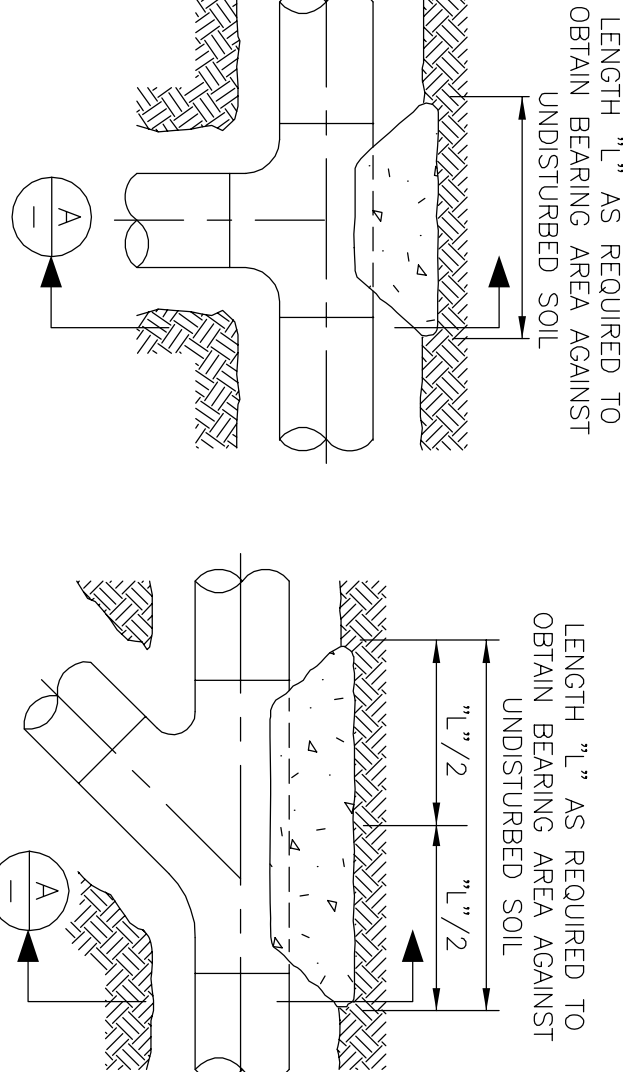
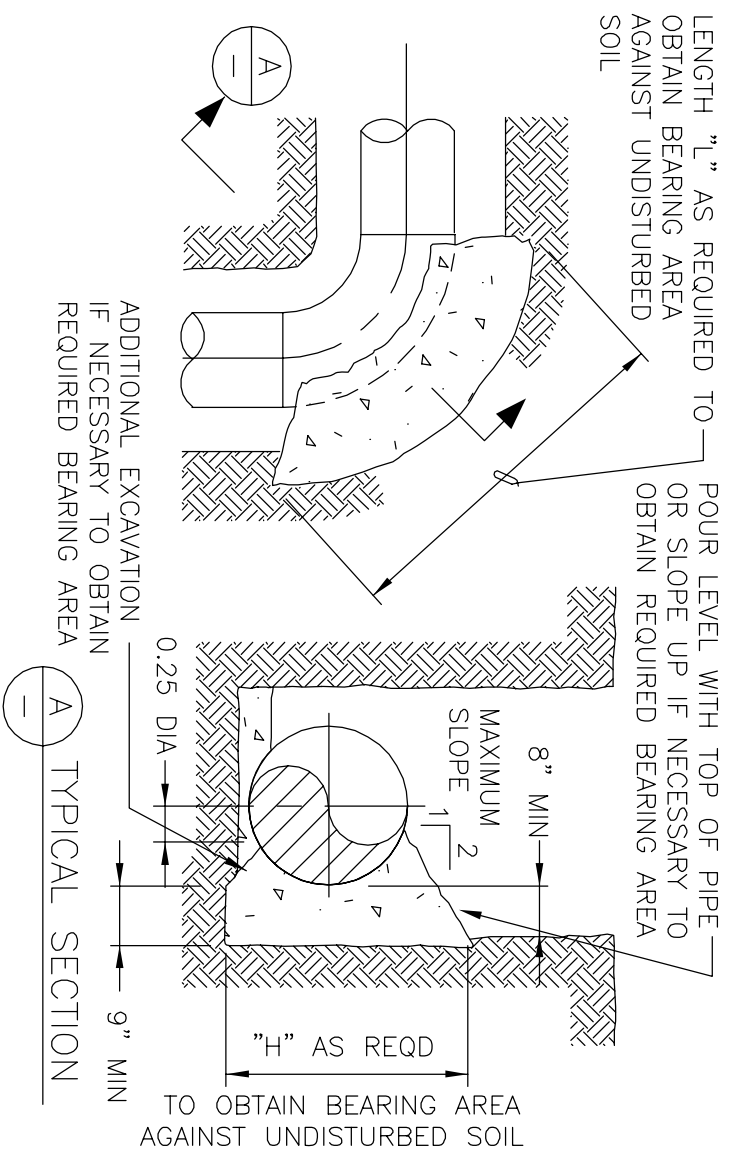
- NOTES:
1. ALL EXPOSED FLEXIBLE COUPLINGS SHALL HAVE TIE RODS UNLESS SPECIFICALLY INDICATED OTHERWISE ON THE DRAWINGS.
  2. DESIGN SHALL BE BASED ON TEST PRESSURE.
  3. ANCHOR LUGS AND TIE RODS FOR STEEL PIPE SHALL BE DESIGNED BY PIPE MANUFACTURER IN ACCORDANCE WITH AWWA M11 STEEL PIPE MANUAL.
  4. GRIND ALL CORNERS SMOOTH.
  5. COAT ALL SURFACES WITH EPOXY PAINT PER SPECIFICATIONS.
  6. APPLY MORTAR WRAP PER SPECIFICATIONS.

P1 STEEL PIPE FLEXIBLE COUPLING  
TYP TIE DOWN



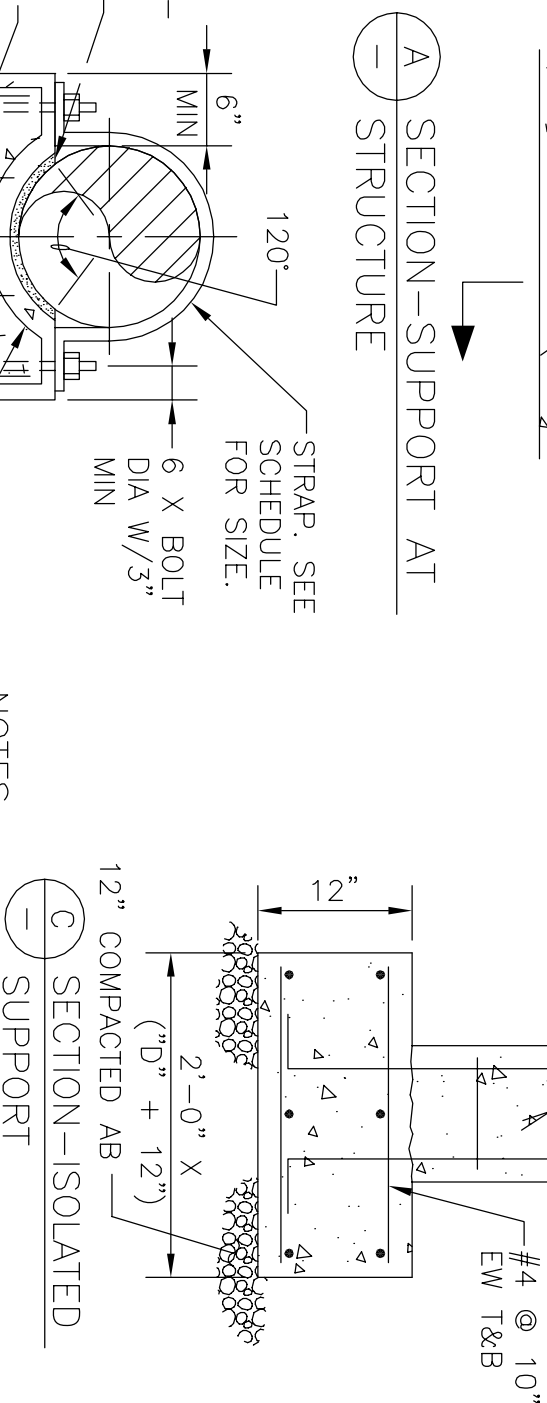
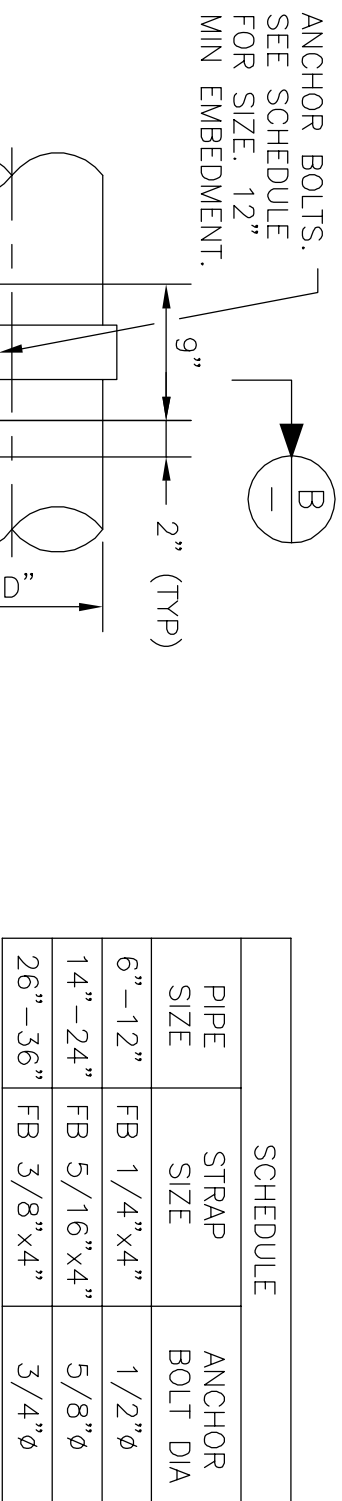
- NOTES:
1. MAXIMUM VERTICAL LOAD = 1400 LBS.
  2. IF SUPPORT IS SUBMERGED OR LOCATED BELOW THE TOP OF WALL BEARING STRUCTURE, MATERIAL FOR ANCHOR BOLTS AND STRAP SHALL BE STAINLESS STEEL. IN ALL OTHER AREAS, MATERIAL FOR ANCHOR BOLTS AND STRAP SHALL BE HOT-DIP GALVANIZED STEEL UNLESS OTHERWISE INDICATED ON THE DRAWINGS.

P4 PIPE SUPPORT  
TYP



- NOTES:
1. BEARING AREA IS THE AREA REQUIRED TO OBTAIN A MAXIMUM SOIL LOADING OF 200 PSF PER FOOT OF DEPTH TO A MAXIMUM VALUE OF 1500 PSF WHEN THE PIPE IS SUBJECTED TO ITS TEST PRESSURE, OR BEARING AREA SHOWN ON PLANS. AREA MAY BE DECREASED IF SUBSTANTIATED BY SOIL BEARING TESTS.
  2. CONCRETE SHALL BE CLASS "A" OR "C".
  3. THRUST BLOCK IS TO EXTEND TO UNDISTURBED SOIL.

P2 PIPE THRUST BLOCK  
TYP



- NOTES:
1. MAX VERTICAL LOAD = 6000 POUNDS.
  2. IF SUPPORT IS SUBMERGED OR LOCATED BELOW THE TOP OF WALL IN WATER BEARING STRUCTURE, MATERIAL FOR ANCHOR BOLTS AND STRAP SHALL BE STAINLESS STEEL. IN ALL OTHER AREAS, MATERIAL FOR ANCHOR BOLTS AND STRAP SHALL BE HOT-DIP GALVANIZED STEEL UNLESS OTHERWISE INDICATED ON THE DRAWINGS.

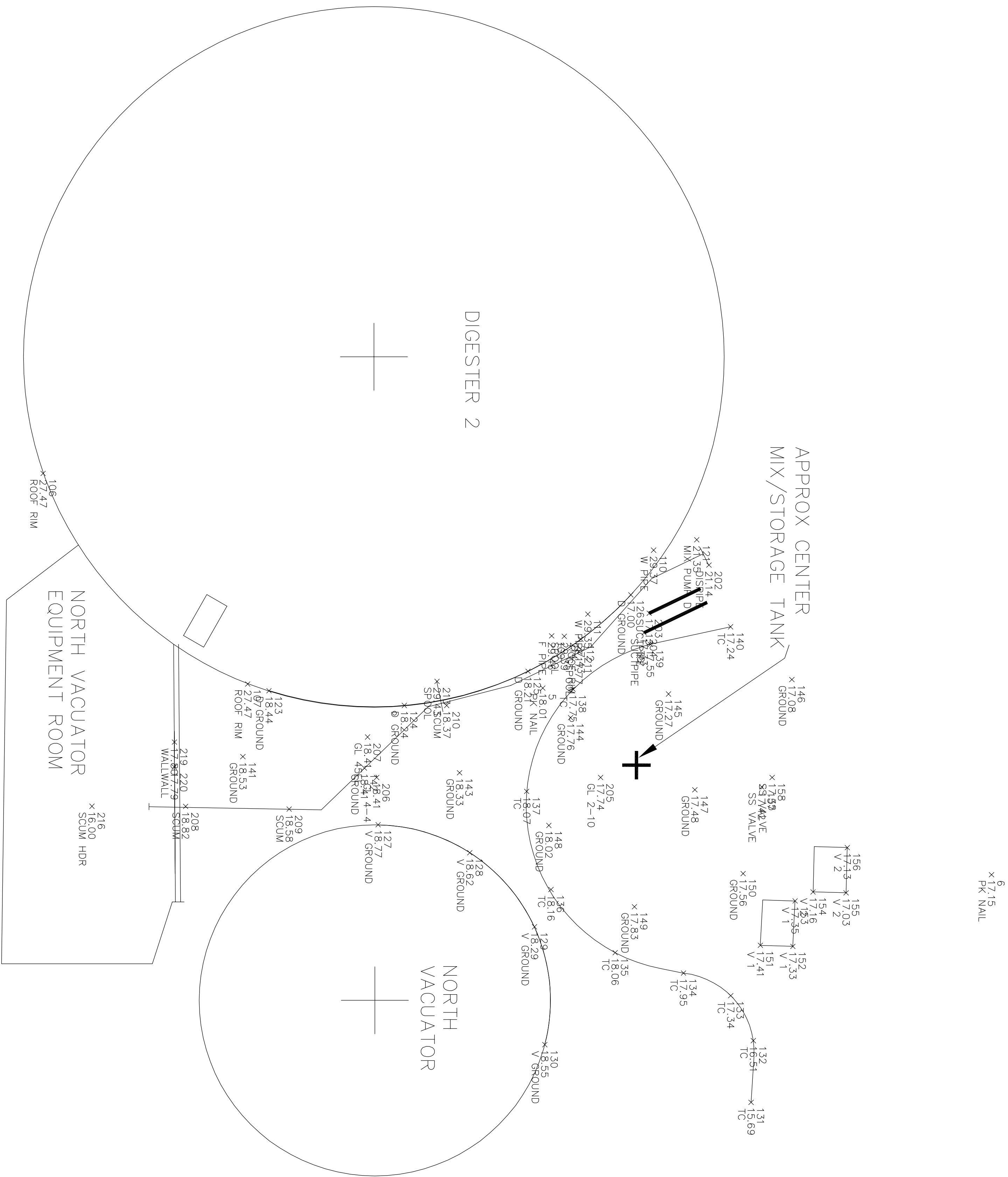
P5 CONCRETE PIPE SUPPORT  
TYP





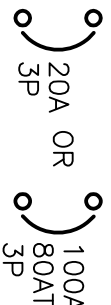














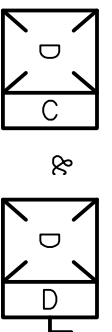
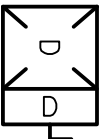




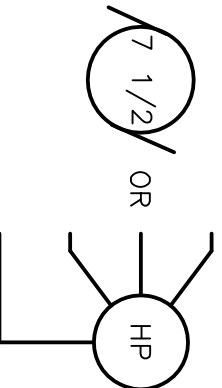

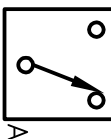
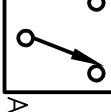
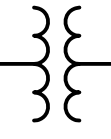



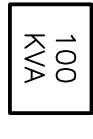
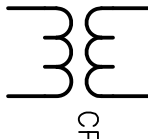






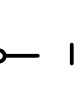

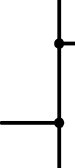


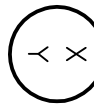
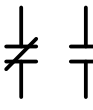
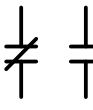



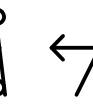
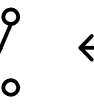
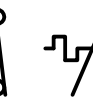
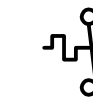


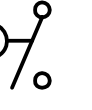
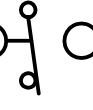
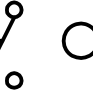
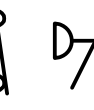
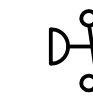
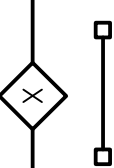
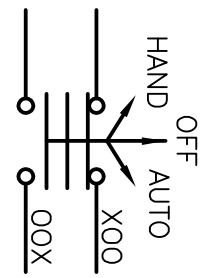
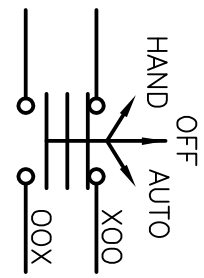










































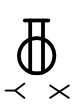
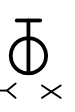


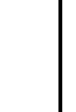






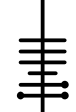

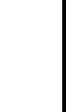






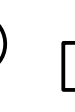

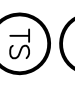












Revised Per  
Addendum #2

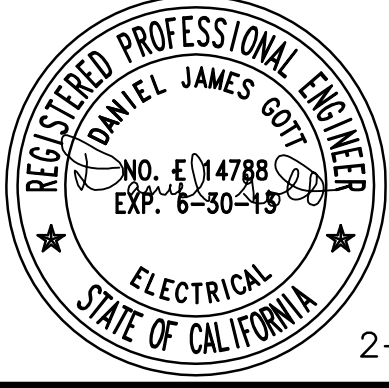


VERIFY SCALE  
BAR IS ONE INCH ON  
ORIGINAL DRAWING  
0 1"  
IF NOT ONE INCH ON  
THIS SHEET, ADJUST  
SCALE ACCORDINGLY

CITY OF HAYWARD DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION				WPCF Grease Receiving and Processing Facility			
DESIGNED BY: DLG				CHECKED BY: GS			
DRAWN BY: TL				APPROVAL REC'D: HL			
APPROVED BY:				APPROVED BY:			
ALEX AMERI PUBLIC WORKS DIRECTOR-UTILITIES				MORAD FAKHRAI, PUBLIC WORKS DIRECTOR ENGINEERING & TRANSPORTATION/CITY ENGINEER			
PROJ. NO.: 7511				DATE: FEB 2012			
REV.	DATE	DESCRIPTION	BY	SCALE: 1"=10'			
				TOTAL SHEETS: 23 FILE NO.: E-2002			
				SHEET NO. 134			

<p>   </p> <p>LOW – VOLTAGE CIRCUIT BREAKER (CB), RATINGS AND NO. OF POLES AS SHOWN, WHEN SPECIFIC TYPE IS REQUIRED. X INDICATES TYPE.</p> <p> <b>TYPES:</b>   MCCB – MOLDED CASE   ICCB – INSULATED CASE   LVP – LOW – VOLTAGE POWER   MCP – MOTOR CIRCUIT PROTECTOR (RATING PER CONNECTED LOAD)   SEPARATELY MOUNTED CIRCUIT BREAKER; SEE ELECTRICAL ONE – LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION   GROUND FAULT PROTECTION   MEDIUM – VOLTAGE CIRCUIT BREAKER   FUSE, SIZE, AND NUMBER OF FUSES AS NOTED   FUSED CUTOFF, CURRENT RATING, FUSE SIZE, AND NUMBER OF POLES AS NOTED   FUSIBLE SWITCH, CURRENT RATING, FUSE SIZE, AND QUANTITY AS NOTED   NON-FUSED SWITCH, CURRENT RATING, AND NUMBER OF POLES AS NOTED   DISCONNECT OR DRAWOUT CONNECTION   MAGNETIC MOTOR STARTER AND SEPARATELY MOUNTED COMBINATION MAGNETIC MOTOR STARTER   MOTOR CONTROLLER AND SEPARATELY MOUNTED MOTOR CONTROLLER WITH SHORT CIRCUIT PROTECTION AND DISCONNECT   MOTOR STARTER AND CONTROLLER SUBSCRIPTS:  A – MAGNETIC STARTER NEMA SIZE  B – STARTER TYPE  NONE – FULL VOLTAGE NON-REVERSING (FVNR)  FVR – FULL VOLTAGE REVERSING  ZS – TWO SPEED  RVAT – REDUCED VOLTAGE AUTO TRANSFORMER  C – CONTROL DIAGRAM OR CONTROLS SCHEDULE NUMBER (IF REQUIRED)  D – CONTROLLER TYPE  VFD – VARIABLE FREQUENCY DRIVE  SS – SOLID STATE   SEPARATELY MOUNTED COMBINATION MOTOR STARTER OR CONTROLLER; SEE ELECTRICAL ONE – LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION   THERMAL OVERLOAD ELEMENT   THERMAL OVERLOAD RELAY CONTACT   DISCONNECT OR SAFETY SWITCH, 30A, 3P, NON-FUSED UNLESS OTHERWISE NOTED   MOTOR WITH DESIGN HORSEPOWER (WHEN INDICATED)   GENERATOR   TRANSFER SWITCH, CURRENT RATING, AND NUMBER OF POLES AS NOTED   ATS – AUTOMATIC MTS – MANUAL   TRANSFORMER   Δ 3-PHASE, 3-WIRE DELTA CONNECTION   ⚡ 3-PHASE, 4-WIRE GROUND WYE CONNECTION   SWITCHBOARD OR PANELBOARD, NAME, VOLTAGE, PHASE, NUMBER OF WIRES WHEN INDICATED   100 KVA   CPT  CONTROL POWER TRANSFORMER (CPT) </p>	<p>  VOLTAGE TRANSFORMER (VT OR PT)   CURRENT TRANSFORMER (CT)   UTILITY WATT-HOUR METER PER UTILITY REQUIREMENTS   DIGITAL METERING PACKAGE   RUN TIME METER   GROUND   LIGHTNING ARRESTER   LOW VOLTAGE SURGE PROTECTIVE DEVICE   ELECTRICAL CONNECTION   NO ELECTRICAL CONNECTION   SOLENOID VALVE   CONTROL/RELAY COIL. X INDICATES TYPE, Y INDICATES LOOP NO. WHEN USED TYPES:  OR – CONTROL RELAY  DP – DEFINITE PURPOSE RELAY  LC – LIGHTING CONTACTOR  M – MOTOR STARTER  PC – PHOTO CELL  TC – TIME CLOCK  TR – TIMING RELAY   NORMALLY OPEN CONTACT (N.O.)   NORMALLY CLOSED CONTACT (N.C.)   NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS ENERGIZED   NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS ENERGIZED   NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS DE-ENERGIZED   NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS DE-ENERGIZED   NORMALLY OPEN TEMPERATURE SWITCH; CLOSE ON RISING TEMPERATURE   NORMALLY CLOSED TEMPERATURE SWITCH; OPEN ON RISING TEMPERATURE   NORMALLY OPEN FLOW SWITCH; CLOSE ON INCREASING FLOW   NORMALLY CLOSED FLOW SWITCH; OPEN ON INCREASING FLOW   NORMALLY OPEN LEVEL SWITCH; CLOSE ON RISING LEVEL   NORMALLY CLOSED LEVEL SWITCH; OPEN ON RISING LEVEL   NORMALLY OPEN PRESSURE SWITCH; CLOSE ON INCREASING PRESSURE   NORMALLY CLOSED PRESSURE SWITCH; OPEN ON INCREASING PRESSURE   NORMALLY OPEN LIMIT SWITCH; CLOSE ON REACHING LIMIT   NORMALLY CLOSED LIMIT SWITCH; OPEN ON REACHING LIMIT   FIELD WIRING EXTERNAL TO CONTROL PANEL. INTERLOCK, X INDICATES TYPE TYPES:  E – ELECTRICAL  M – MECHANICAL  K – KEY </p>	<p>  OFF HAND 1 AUTO X   3 POSITION SELECTOR SWITCH, MAINTAINED CONTACTS; UNLESS OTHERWISE NOTED, 2-POSITION SIMILAR   NORMALLY OPEN PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED   NORMALLY CLOSED PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED   INDICATING LIGHT, X INDICATES LENS COLOR   PUSH TO TEST INDICATING LIGHT, X INDICATES LENS COLOR   LENS COLORS:  R – RED  G – GREEN  B – BLUE  Y – YELLOW  W – WHITE  A – AMBER   TRANSFORMER   SELECTOR SWITCH   PUSHBUTTON   INSTRUMENTATION/CONTROL DEVICE   CONTROL PANEL, INTEGRAL OR PROVIDED WITH ASSOCIATED EQUIPMENT   CONTROL PANEL WITH DISCONNECT SWITCH INTEGRAL OR PROVIDED WITH ASSOCIATED EQUIPMENT   JUNCTION OR PULL BOX   PANELBOARD (250V TO 600V)   PANELBOARD (LESS THAN 250V)   ELECTRICAL EQUIPMENT ENCLOSURE: SWITCHBOARD, MOTOR CONTROL CENTER, CONTROL PANEL, OR OTHER EQUIPMENT AS INDICATED   PHOTOCELL   CEILING/PENDANT-MOUNTED LUMINAIRE – HID, COMPACT FLUORESCENT, OR INCANDESCENT   WALL-MOUNTED LUMINAIRE – HID, COMPACT FLUORESCENT, OR INCANDESCENT   CEILING/PENDANT-MOUNTED FLUORESCENT FIXTURE   WALL-MOUNTED FLUORESCENT FIXTURE   CEILING/PENDANT-MOUNTED FLUORESCENT FIXTURE NORMAL/EMERGENCY   WALL-MOUNTED FLUORESCENT FIXTURE NORMAL/EMERGENCY   EMERGENCY LIGHT FIXTURE, 2 ATTACHED HEADS AS SHOWN   EMERGENCY LIGHT, REMOTE MOUNTED HEAD   DOUBLE-FACED CEILING OR WALL-MOUNTED EXIT LIGHT; DIRECTIONAL ARROWS (IF REQUIRED) AS INDICATED ON PLANS   SINGLE-FACED CEILING OR WALL-MOUNTED EXIT LIGHT; DIRECTIONAL ARROWS (IF REQUIRED) AS INDICATED ON PLANS   AREA OR ROADWAY LIGHT – POLE-MOUNTED   LIGHTING FIXTURE SUBSCRIPTS:  X – INDICATES FIXTURE TYPE PER LIGHTING FIXTURE SCHEDULE  Y – INDICATES CIRCUIT NUMBER FROM PANELBOARD  Z – INDICATES CONTROLLING SWITCH (IF REQUIRED)   TOGGLE SWITCH   X – INDICATES TYPE   NONE – SINGLE POLE   4 – FOUR-WAY   3 – THREE-WAY   HP – TOGGLE SWITCH, HORSEPOWER RATED   TS – MANUAL MOTOR STARTER WITH THERMAL ELEMENT   P – PILOT LIGHT   L – LIGHTED HANDLE   Y – INDICATES CONTROLLING SWITCH (IF REQUIRED)   SPECIAL-PURPOSE RECEPTACLE AS DEFINED ON PLANS   PLUG-IN RECEPTACLE STRIP, QUANTITY AND SPACING OF RECEPTACLES AS NOTED OR SPECIFIED   TELECOMMUNICATIONS OUTLET JUNCTION BOX   QUAD-DUPLEX RECEPTACLE, TWO NEMA 5-20R UNDER COMMON COVER PLATE </p>	<p>  DUPLEX RECEPTACLE, NEMA 5-20R   SIMPLEX RECEPTACLE, NEMA 5-20R   SUBSCRIPTS:  X – INDICATES TYPE  G/C – GROUND FAULT CIRCUIT INTERRUPTER  Y – INDICATES CIRCUIT NUMBER FROM PANELBOARD   CONDUIT TURNING UP   CONDUIT TURNING DOWN   HOME RUN TO PANEL, 2 #12, 1 #12G IN 3/4" UNLESS OTHERWISE NOTED   CONDUIT RUN BETWEEN DEVICES EXPOSED IN NON-ARCHITECTURALLY FINISHED AREAS OR CONCEALED IN ARCHITECTURALLY FINISHED AREAS. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT.   CONDUIT RUN BETWEEN DEVICES CONCEALED IN NON-ARCHITECTURALLY FINISHED AREAS OR CONCEALED IN ARCHITECTURALLY FINISHED AREAS. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT.   CIRCUIT HASH MARKS (WHEN INDICATED); LONG, SHORT, SINGLE DOT, AND DOUBLE DOT REPRESENT HASHED FIELD EQUIPMENT, GROUND AND ISOLATED EQUIPMENT, RESPECTIVELY. #12 IN 3/4" CONDUIT UNLESS OTHERWISE INDICATED   CIRCUIT CONTINUATION   CONDUIT STUBBED OUT AND CAPPED   CONDUIT TAG OR CIRCUIT NUMBER – WIRE AND CONDUIT SIZE AS SPECIFIED IN CIRCUIT SCHEDULE ON THE SHEETS   GROUND CABLE   GROUND ROD   FIRE ALARM ANNUNCIATOR   FIRE ALARM CONTROL PANEL   FIRE ALARM MANUAL PULL STATION   FIRE ALARM CONTROL RELAY   FIRE ALARM CONTACT, FLOW SWITCH   FIRE ALARM CONTACT, TAMPER SWITCH   FIRE ALARM CONTACT, PRESSURE SWITCH   SMOKE AND DUCT DETECTOR   I – IONIZATION TYPE   P – PHOTOELECTRIC TYPE   HEAT DETECTOR   SUBSCRIPT:  R/C – RATE COMPENSATION  R/F – COMBINATION RATE OF RISE  P – RATE OF RISE  F – FIXED   ALARM BELL   ALARM HORN   ALARM FLASHING LIGHT   ALARM BELL AND FLASHING LIGHT   ALARM HORN AND FLASHING LIGHT   COMBINATION UNIT   SUBSCRIPT:  NONE – GENERAL ALARM DEVICE  F – FIRE ALARM DEVICE </p>	<p> <b>GENERAL NOTES:</b>  1. THIS IS A STANDARD ELECTRICAL SYMBOLS SHEET. NOT ALL SYMBOLS MAY BE USED ON THIS PROJECT.  2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE-EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.  3. SEE P&amp;ID LEGEND SHEET FOR PROJECT-SPECIFIC EQUIPMENT SYMBOLS, EQUIPMENT ABBREVIATIONS, AND PIPING SYSTEM ABBREVIATIONS. </p>
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Revised per  
Addendum #2



2-16-12



REV.	DATE	DESCRIPTION	BY
1	3/22/12	ADDENDUM #2	DG

CITY OF HAYWARD DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION			
DESIGNED BY:	D. GOTT	CHECKED BY:	L. D. SMITHY
DRAWN BY:	E. SESENE	APPROVAL REC'D:	
APPROVED BY:	D. CLARK	APPROVED BY:	
ALEX AMERI PUBLIC WORKS DIRECTOR-UTILITIES		MORAD FAHRAH, PUBLIC WORKS DIRECTOR ENGINEERING & TRANSPORTATION/CITY ENGINEER	
PROJ. NO.:	7511	DATE:	9/13/11

GREASE RECEIVING STATION		ELECTRICAL SYMBOLS LEGEND	
SCALE: NOT TO SCALE		TOTAL SHEETS:	E-01
		FILE NO.:	SHEET NO.

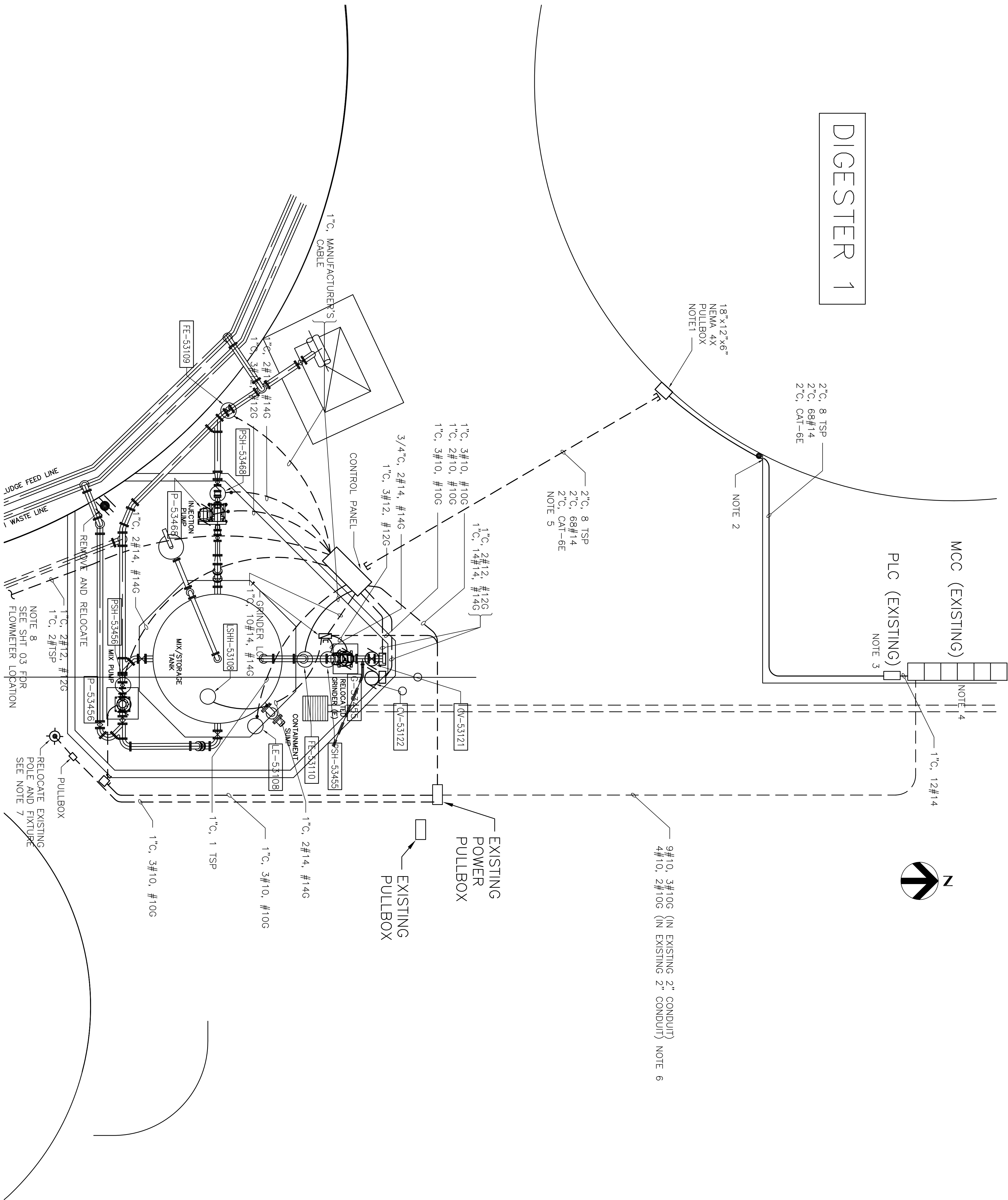


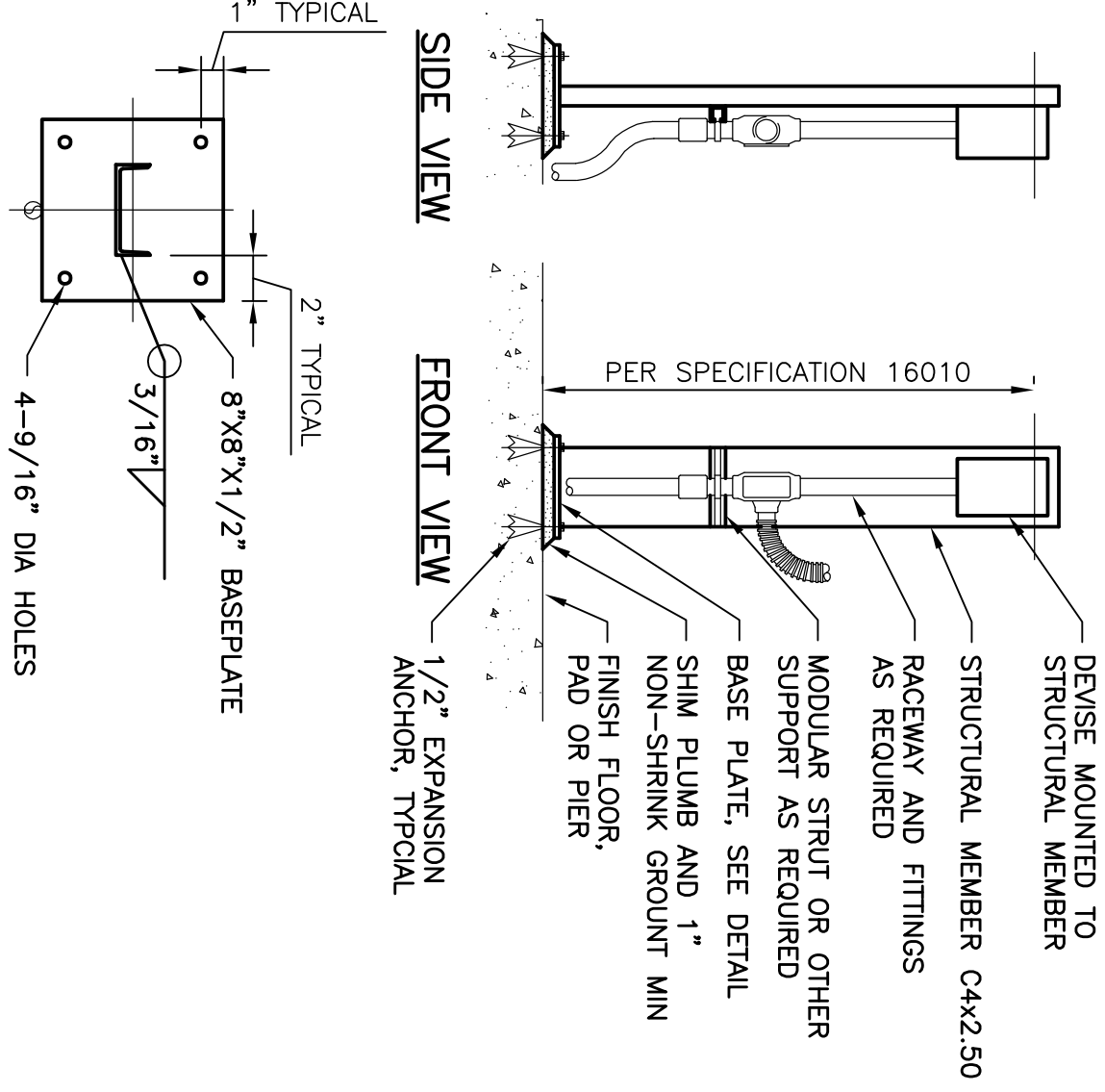






DIGESTER 1





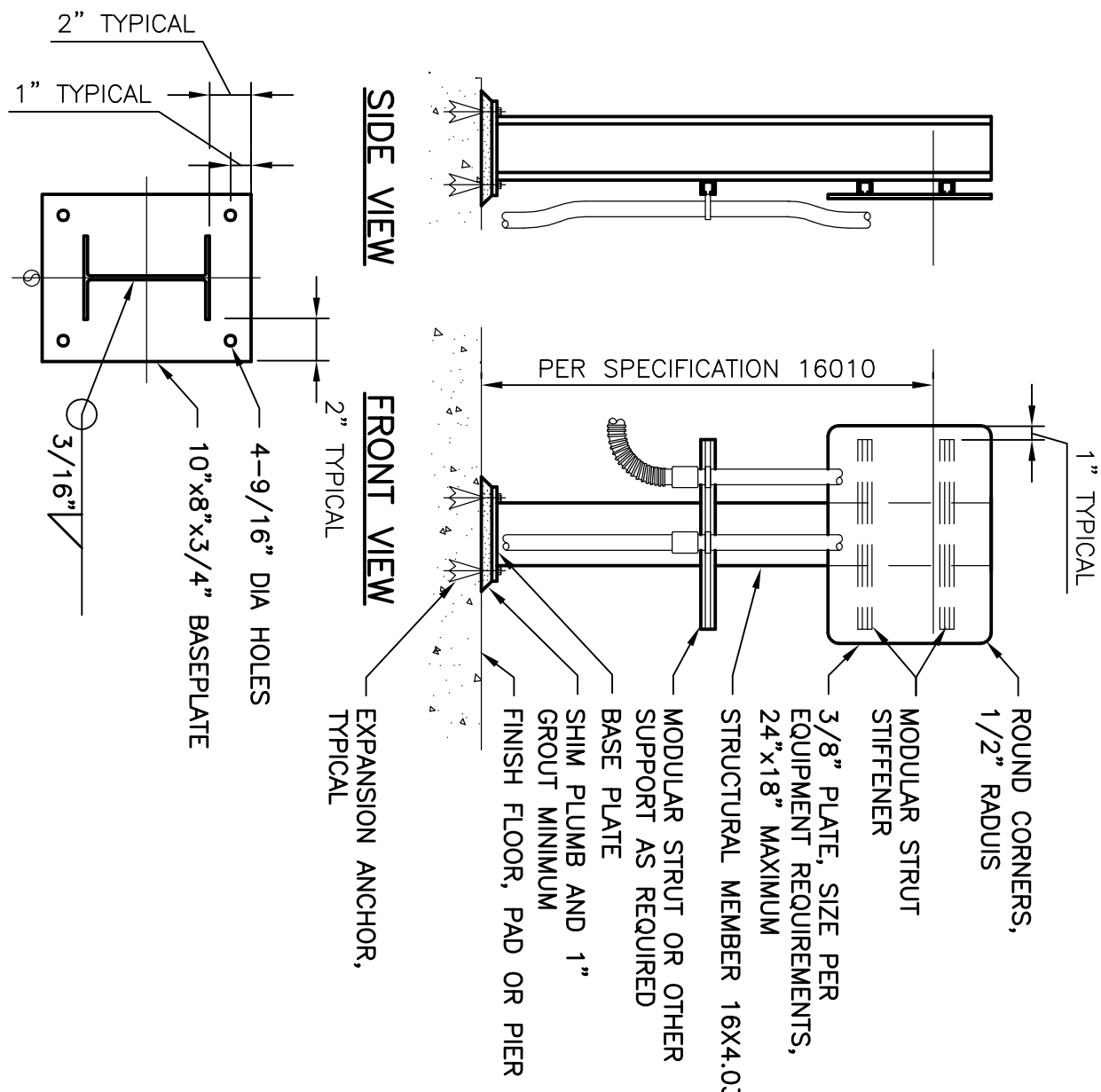
BASE PLATE PLAN VIEW

NOTES:

- EQUIPMENT LOAD SHALL NOT EXCEED 50 POUNDS.
- PEDESTAL ASSEMBLY MATERIAL TYPE: ALUMINUM.
- ANCHORS: STAINLESS STEEL, 1/2" DIAMETER, 3 1/2" EMBEDMENT.
- ATTACH MODULAR STRUT TO STRUCTURAL MEMBER WITH A MINIMUM OF TWO 3/8" DIAMETER STAINLESS STEEL ROUND HEAD MACHINE SCREWS WITH LOCK WASHER AND NUT.
- PROTECT SURFACES WITH DISSIMILAR MATERIALS IN ACCORDANCE WITH SPECIFICATION 09905.

SINGLE DEVICE PEDESTAL

NTS



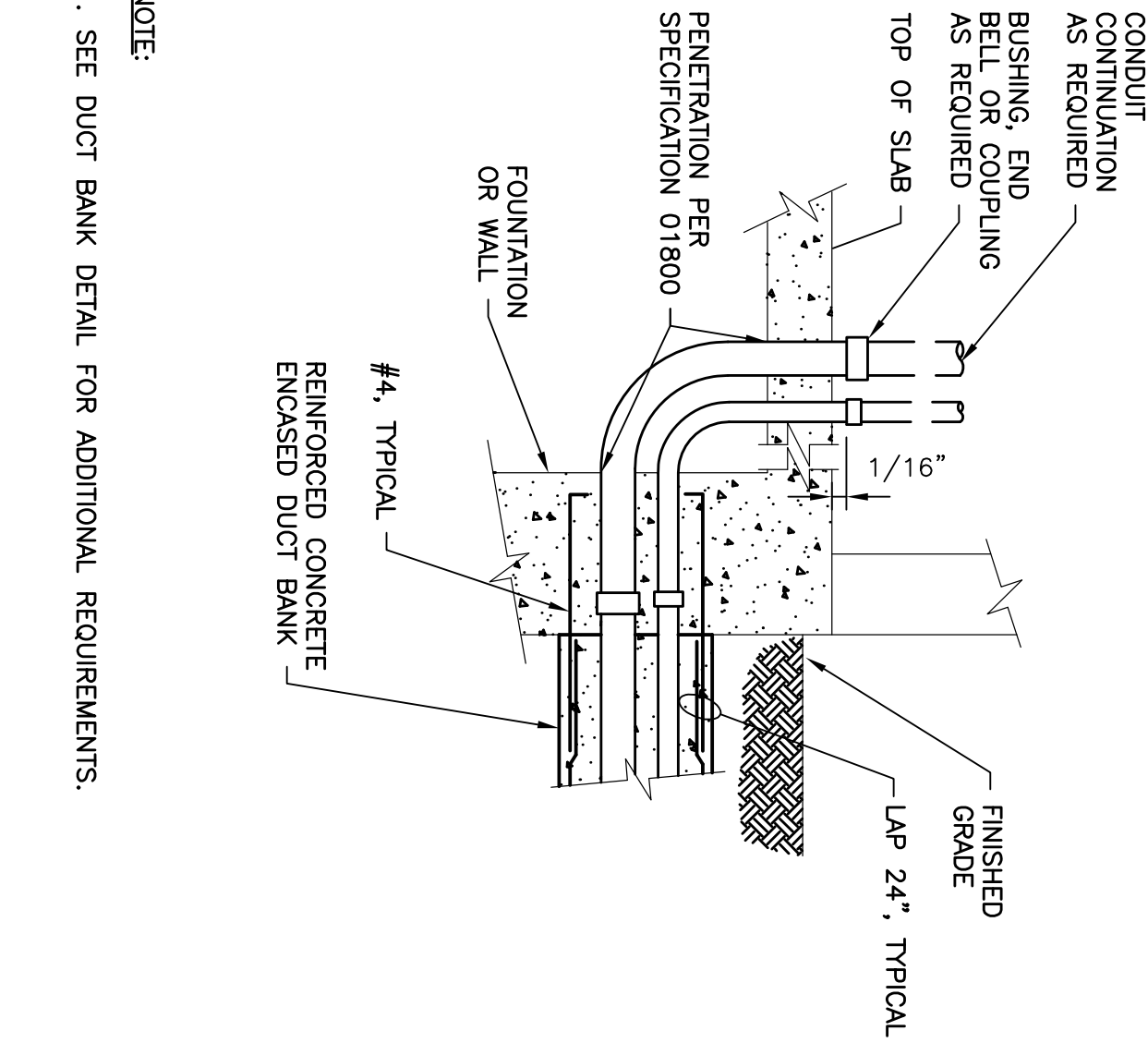
BASE PLATE PLAN VIEW

NOTES:

- EQUIPMENT LOAD SHALL NOT EXCEED 200 POUNDS.
- PEDESTAL ASSEMBLY MATERIAL TYPE: ALUMINUM.
- ANCHORS: STAINLESS STEEL, 1/2" DIAMETER, 3 1/2" EMBEDMENT.
- PROTECT SURFACES WITH DISSIMILAR MATERIALS IN ACCORDANCE WITH SPECIFICATION 09905.

EQUIPMENT PEDESTAL FED FROM BELOW

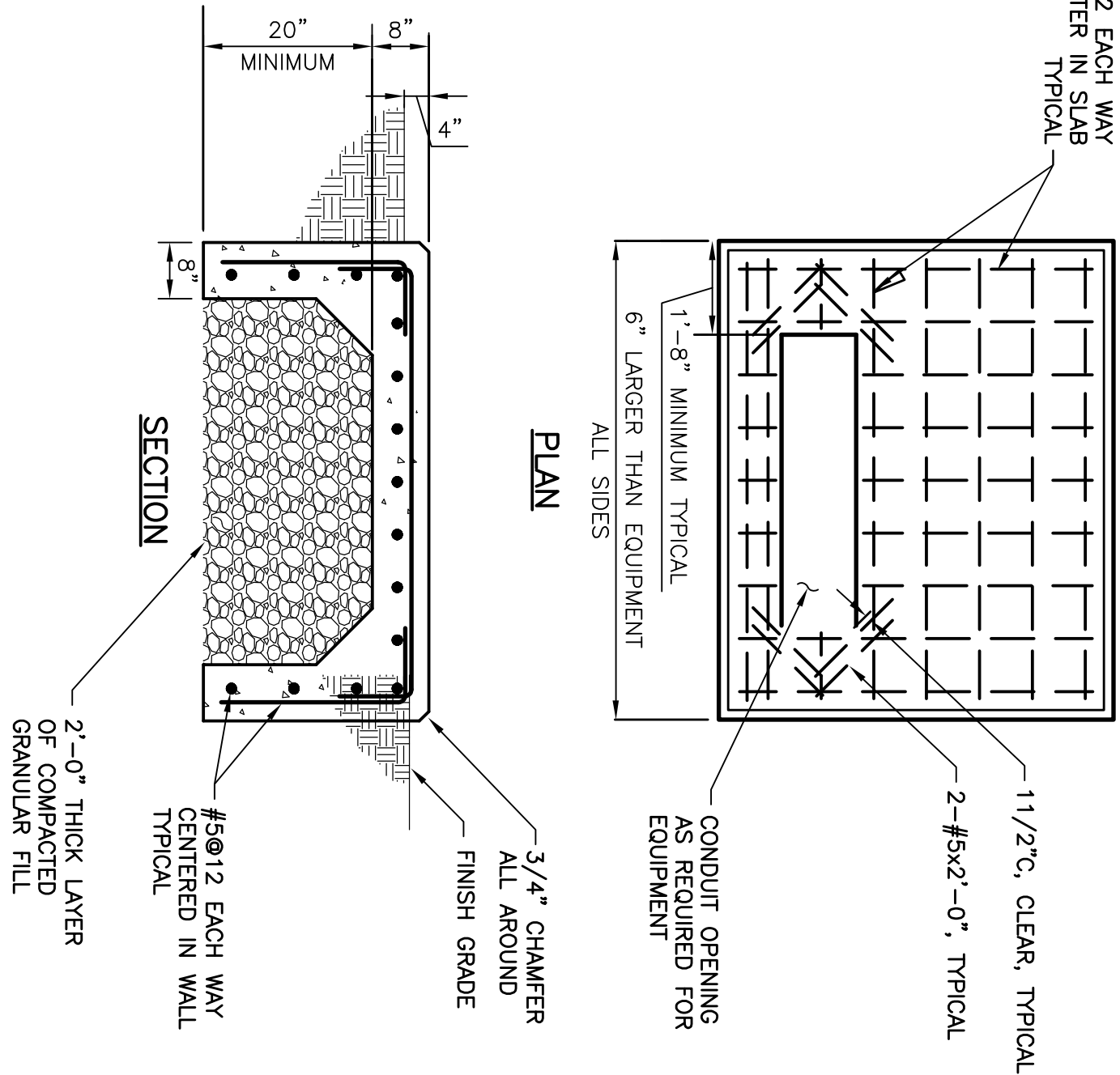
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- NOTE:
- SEE DUCT BANK DETAIL FOR ADDITIONAL REQUIREMENTS.

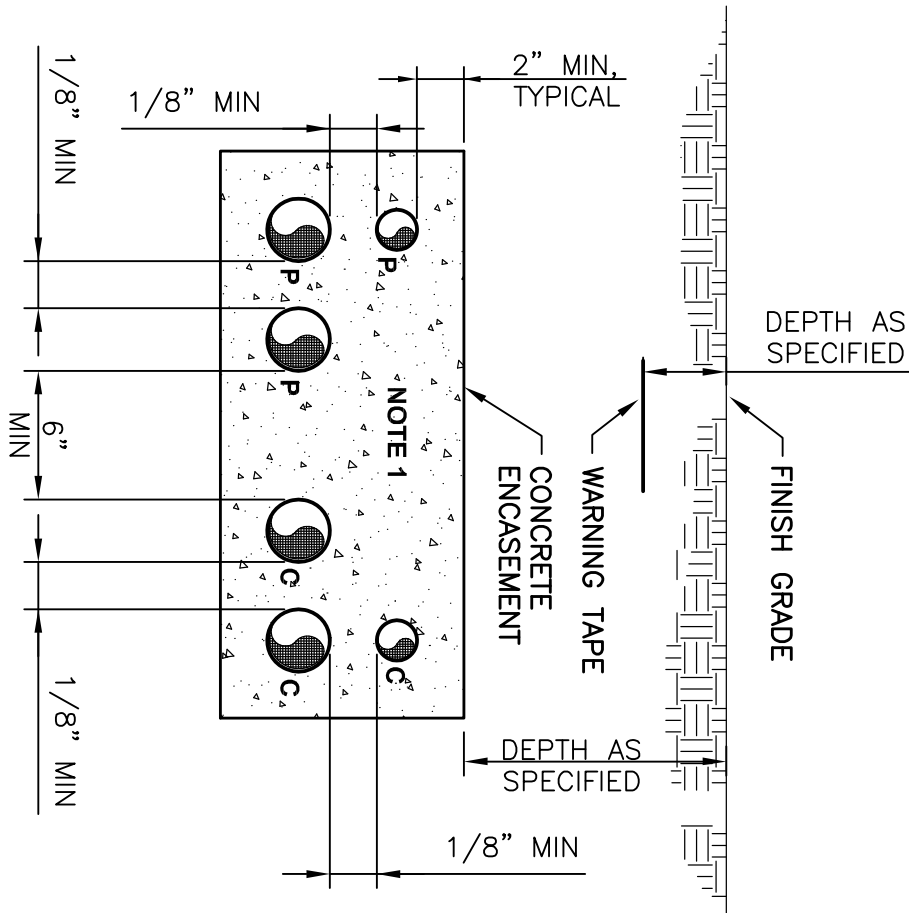
CONDUIT TRANSITION TO ABOVE GRADE (EXTERIOR TO INTERIOR)

NTS



REINFORCED CONCRETE PAD FOR OUTDOOR ELECTRICAL EQUIPMENT

NTS

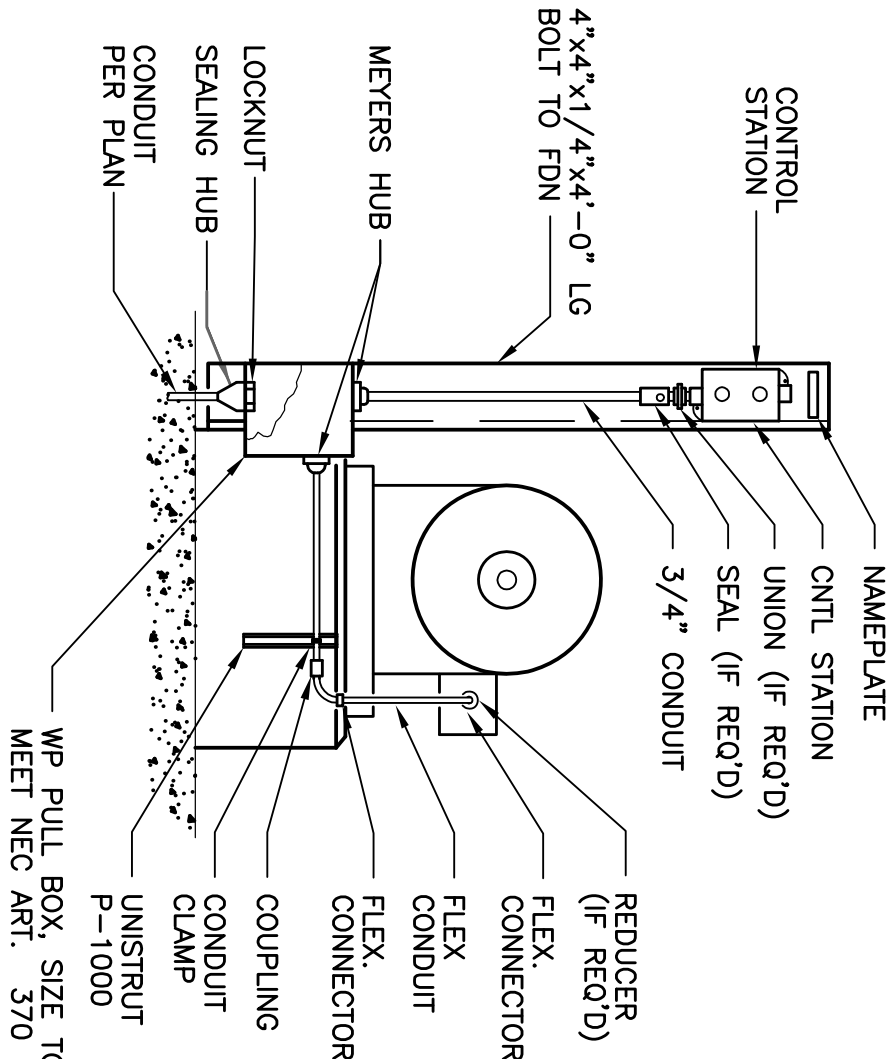


NOTES:

- NUMBER OF CONDUITS AS REQUIRED FOR THE APPLICATION.
- P SUBSCRIPT ELECTRICAL POWER OR CONTROL CONDUIT.
- C SUBSCRIPT COMMUNICATION (TELEPHONE, DATA, INSTRUMENTATION) CONDUIT.

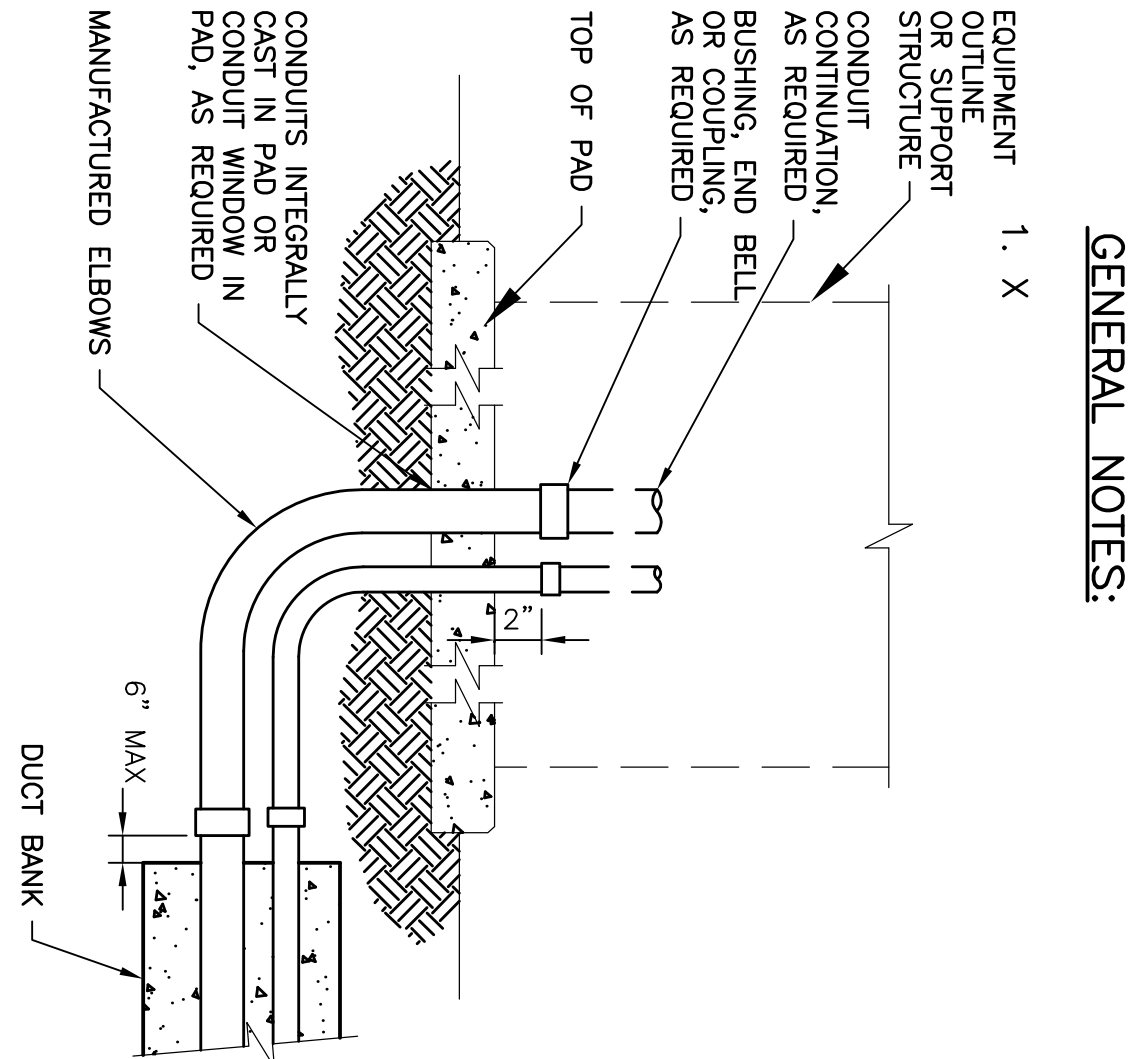
CONCRETE ENCASED DUCT BANK SECTION

NTS



MOTOR CONDUIT CONNECTION

NTS



GENERAL NOTES:

- EQUIPMENT OUTLINE OR SUPPORT STRUCTURE CONDUIT CONTINUATION, AS REQUIRED BUSHING, END BELL OR COUPLING, AS REQUIRED
- SEE OTHER CONTRACT DRAWING FOR PAD REQUIREMENTS.

CONDUIT TRANSITION TO ABOVE GRADE (EXTERIOR)

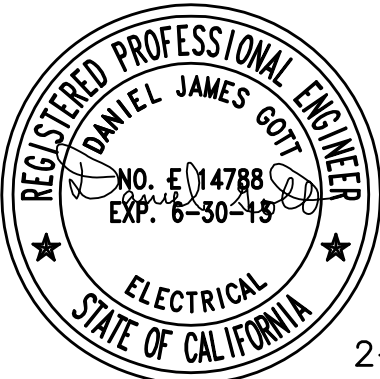
NTS

DIMENSION SCHEDULE			
POLE HEIGHT	MINIMUM	MINIMUM	VERTICAL CLEARANCE
UP TO 10'	2'-0"	4'-6"	6
11' TO 20'	2'-0"	6'-6"	6
21' TO 30'	2'-0"	8'-6"	6
31' TO 40'	2'-0"	9'-6"	8
41' TO 50'	2'-6"	10'-6"	10

LIGHT POLE FOUNDATION

NTS

Revised per Addendum #2



2-16-12

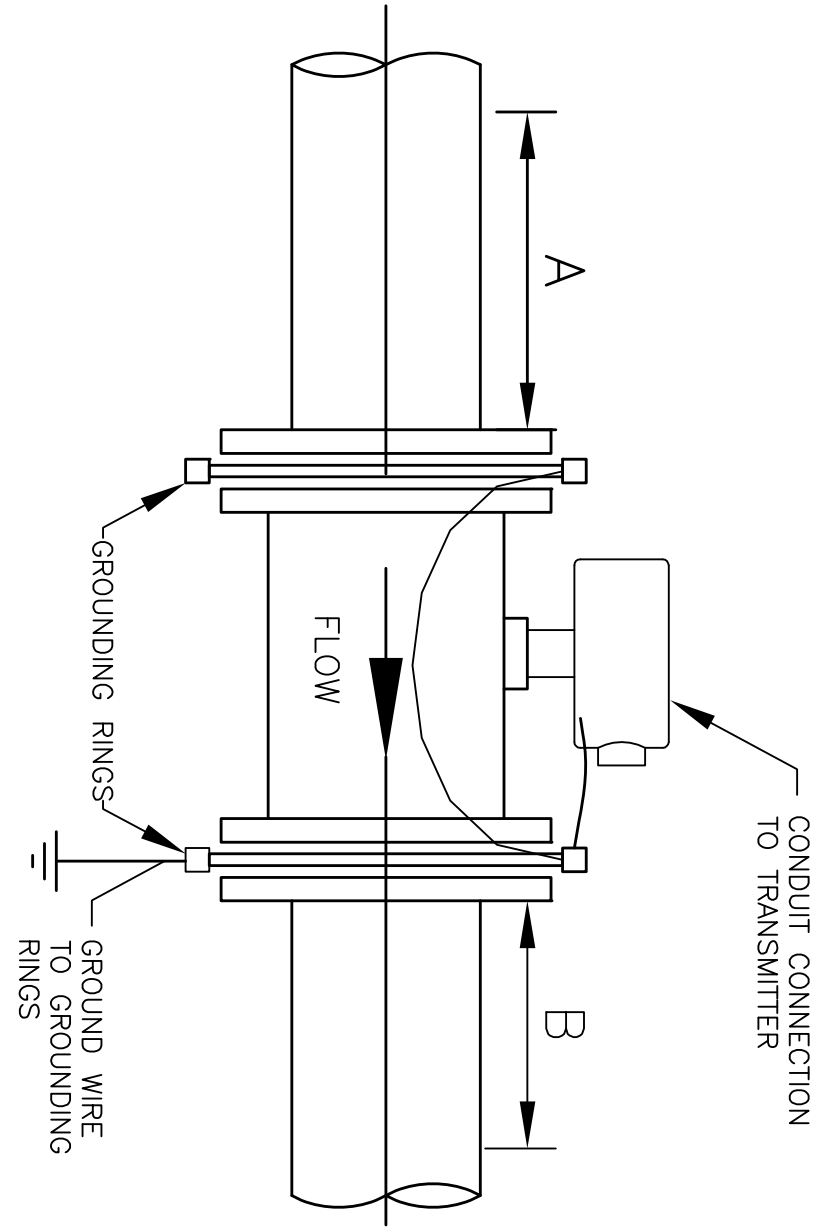


REV.	DATE	DESCRIPTION	BY
1	3/22/12	ADDENDUM #2	DG

CITY OF HAYWARD DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION			
DESIGNED BY:	D. GOTT	CHECKED BY:	L. D. SMITHY
DRAWN BY:	E. SESENE	APPROVAL REC'D:	
APPROVED BY:	D. CLARK	APPROVED BY:	
ALEX AMERI PUBLIC WORKS DIRECTOR-UTILITIES		MORAD FAHRAH, PUBLIC WORKS DIRECTOR ENGINEERING & TRANSPORTATION/CITY ENGINEER	
PROJ. NO.:	7511	DATE:	9/15/11

GREASE RECEIVING STATION			
ELECTRICAL DETAILS I			
SCALE: NOT TO SCALE	TOTAL SHEETS: _____	SHEET NO. 19	
	FILE NO.:		

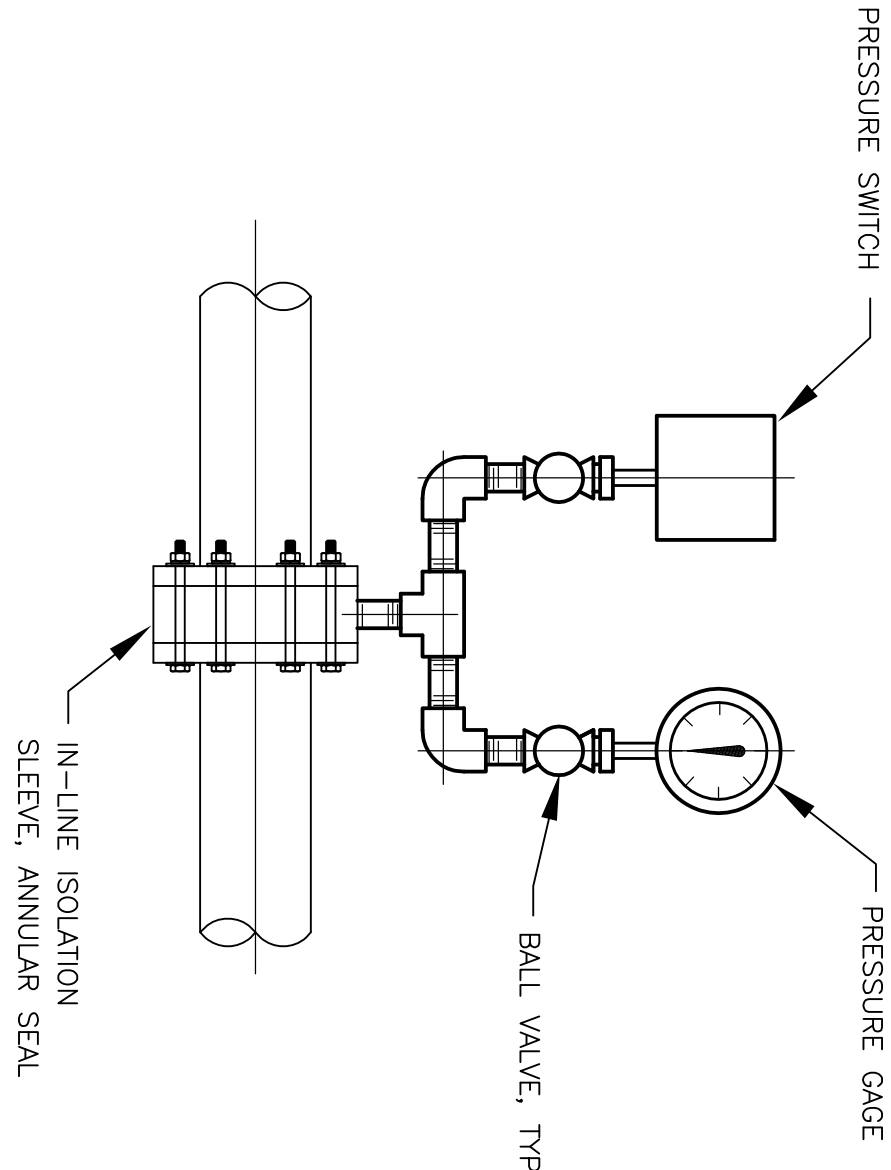
E-06



- NOTES:**
1. MINIMUM OF 10 PIPE DIAMETERS UPSTREAM, DIMENSION A.
  2. MINIMUM OF 5 PIPE DIAMETERS DOWNSTREAM, DIMENSION B.

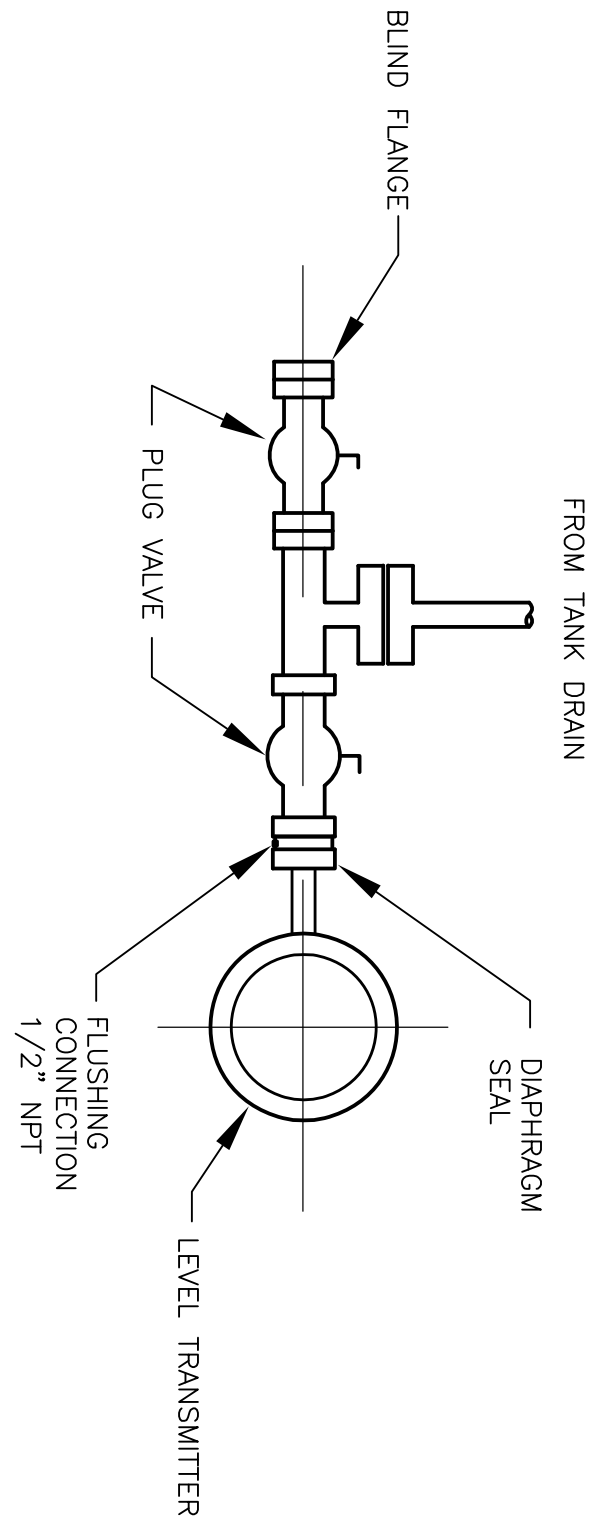
**ELECTROMAGNETIC FLOWMETER  
INLINE MOUNTED**

SCALE: NTS



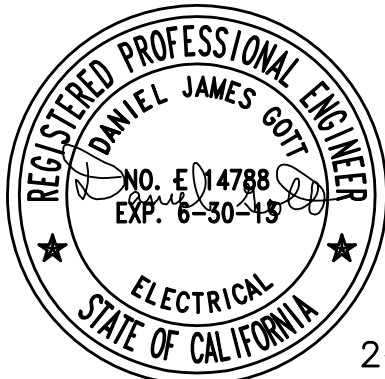
**PRESSURE INDICATOR PG-2**

SCALE: NTS



**TANK MOUNTED  
PRESSURE ELEMENT**

NTS



2-16-12

**HDR**

HDR Engineering, Inc.

REV.	DATE	DESCRIPTION	BY
1	3/22/12	ADDENDUM #2	DG

CITY OF HAYWARD DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION			
DESIGNED BY:	D. GOTT	CHECKED BY:	L. D. SMITHY
DRAWN BY:	E. SESPENE	APPROVAL REC'D:	
APPROVED BY:	D. CLARK	APPROVED BY:	
ALEX AMERI PUBLIC WORKS DIRECTOR-UTILITIES		MORAD FAHRAH, PUBLIC WORKS DIRECTOR ENGINEERING & TRANSPORTATION/CITY ENGINEER	
PROJ. NO.: 7511		DATE: 9/13/11	

GREASE RECEIVING STATION

**ELECTRICAL  
DETAILS II**

SCALE: NOT TO SCALE

TOTAL SHEETS:

FILE NO.:

E-07

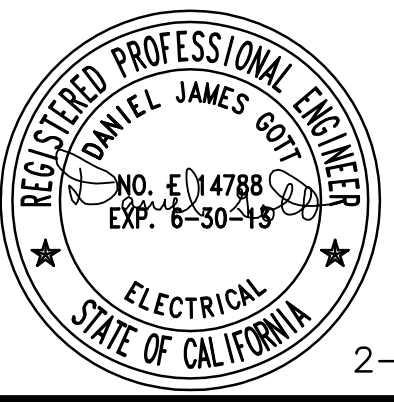
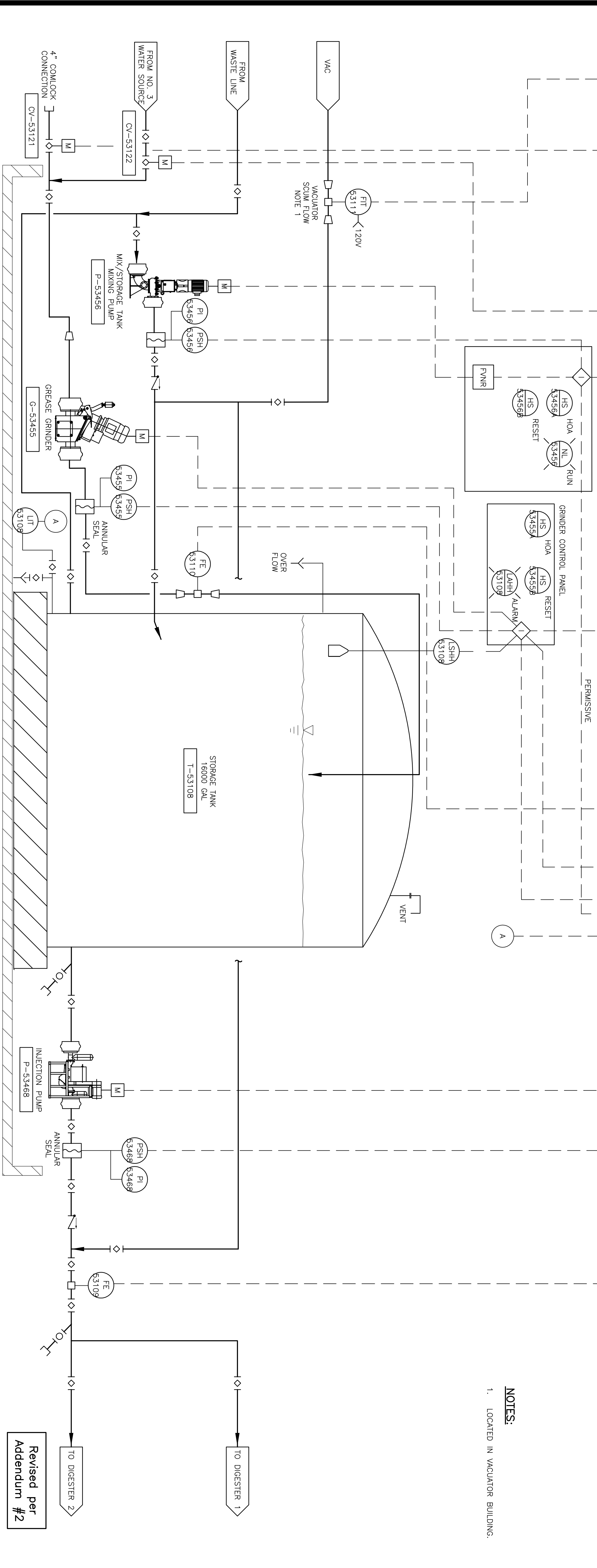
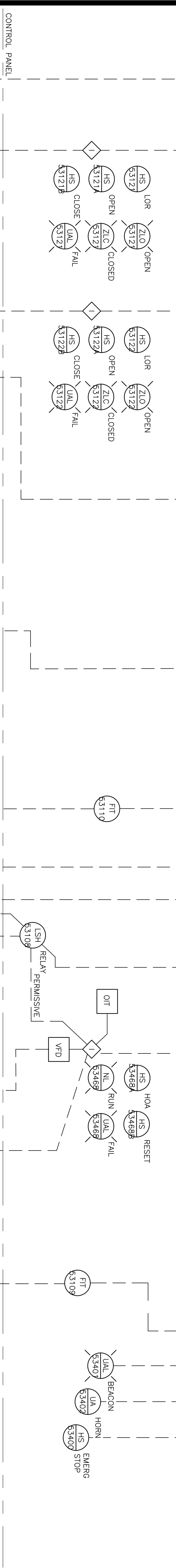
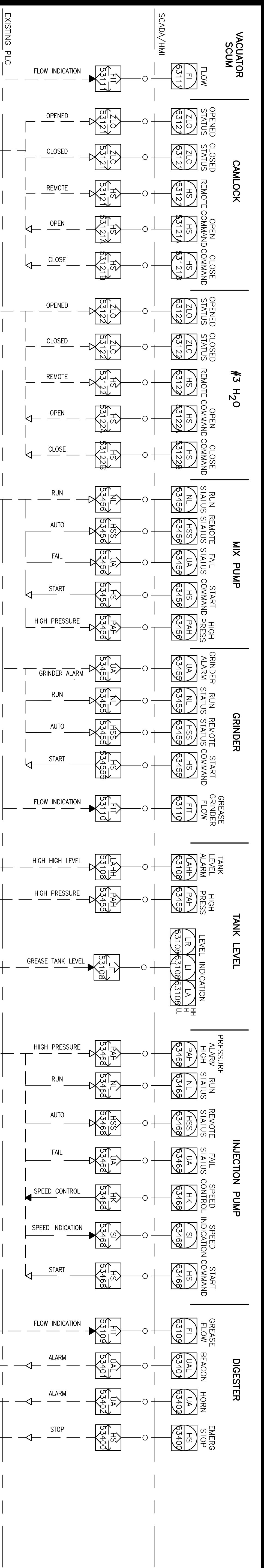
SHEET NO.

20

Revised per  
Addendum #2



PRIMARY ELEMENT SYMBOLOGY		INSTRUMENT SYMBOLOGY		INSTRUMENT IDENTIFICATION LETTERS				CONTROL SWITCH NOTATION ABBREVIATIONS		PROCESS ABBREVIATIONS OPERATING FLUID																																																																																																																																											
<div><div></div><div>ORIFICE PLATE</div></div> <div><div></div><div>PILOT TUBE OR ANNUBAR</div></div> <div><div></div><div>ROTMETER</div></div> <div><div></div><div>SONIC OR ULTRASONIC FLOWMETER</div></div> <div><div></div><div>MAGNETIC FLOWMETER</div></div> <div><div></div><div>THERMAL DISPERSION FLOWMETER</div></div> <div><div></div><div>FLUME</div></div> <div><div></div><div>WEIR</div></div> <div><div></div><div>PROPELLER OR TURBINE METER</div></div> <div><div></div><div>VENTURI TUBE</div></div> <div><div></div><div>FLOAT SWITCH</div></div> <div><div></div><div>TEMPERATURE ELEMENT WITH THERMOWELL</div></div> <div><div></div><div>SIGHT FLOW GLASS</div></div> <div><div></div><div>ULTRASONIC LEVEL ELEMENT</div></div>		<div><div></div><div>LOCALLY MOUNTED FIELD INSTRUMENTATION</div></div> <div><div></div><div>MOUNTED ON PANEL, FRONT</div></div> <div><div></div><div>MOUNTED INSIDE PANEL</div></div> <div><div></div><div>FRONT PANEL, MOUNTED ON AUXILIARY PANEL (SUBSCRIPT INDICATES PANEL)</div></div> <div><div></div><div>MOUNTED INSIDE AUXILIARY PANEL</div></div> <div><div></div><div>PILOT LIGHT</div></div> <div><div></div><div>INSTRUMENT FUNCTIONS SHARING COMMON HOUSING</div></div> <div><div></div><div>COMPLEX INTERLOCK AS DEFINED IN CONTROL DIAGRAM OR IN SPECIFICATIONS</div></div> <div><div></div><div>SHARED DISPLAY, SHARED CONTROL, FIELD MOUNTED</div></div> <div><div></div><div>SHARED DISPLAY, SHARED CONTROL AT PRIMARY LOCATION - NORMALLY ACCESSIBLE TO OPERATOR (SODA WORKSTATION)</div></div> <div><div></div><div>SHARED DISPLAY, SHARED CONTROL AT AUXILIARY LOCATION - NORMALLY ACCESSIBLE TO OPERATOR (IPC, HW)</div></div> <div><div></div><div>PROGRAMMABLE LOGIC CONTROL, PRIMARY LOCATION - NORMALLY INACCESSIBLE TO OPERATOR</div></div> <div><div></div><div>COUPLING</div></div> <div><div></div><div>DIAPHRAGM SEAL</div></div> <div><div></div><div>ANNULAR SEAL</div></div>		<table><thead><tr><th colspan="2">FIRST LETTER</th><th colspan="3">SUCCEEDING LETTERS</th></tr><tr><th>MEASURED OR INITIATING VARIABLE</th><th>MODIFIER</th><th>READOUT OR PASSIVE FUNCTION</th><th>OUTPUT FUNCTION</th><th>MODIFIER</th></tr></thead><tbody><tr><td>A</td><td>ANALYSIS</td><td></td><td>ALARM</td><td></td></tr><tr><td>B</td><td>BURNER</td><td></td><td>USER'S CHOICE</td><td>USER'S CHOICE</td></tr><tr><td>C</td><td>USERS CHOICE</td><td></td><td>CONTROL</td><td>CLOSED</td></tr><tr><td>D</td><td>USERS CHOICE</td><td>DIFFERENTIAL</td><td></td><td></td></tr><tr><td>E</td><td>VOLTAGE</td><td>SENSOR (PRIMARY ELEMENT)</td><td></td><td></td></tr><tr><td>F</td><td>FLOW RATE</td><td>RATIO (FRACTION)</td><td></td><td></td></tr><tr><td>G</td><td>USERS CHOICE</td><td>GLASS, VIEWING DEVICE</td><td></td><td></td></tr><tr><td>H</td><td>HAND</td><td></td><td></td><td>HIGH</td></tr><tr><td>I</td><td>CURRENT (ELECTRICAL)</td><td>INDICATE</td><td></td><td></td></tr><tr><td>J</td><td>POWER</td><td>SCAN</td><td></td><td></td></tr><tr><td>K</td><td>TIME SCHEDULE</td><td>TIME, RATE OF CHANGE</td><td>CONTROL STATION</td><td></td></tr><tr><td>L</td><td>LEVEL</td><td></td><td>LIGHT</td><td>LOW</td></tr><tr><td>M</td><td>USER'S CHOICE</td><td>MOMENTARY</td><td></td><td>MIDDLE INTERMEDIATE</td></tr><tr><td>N</td><td>USER'S CHOICE</td><td></td><td>USER'S CHOICE</td><td>USER'S CHOICE</td></tr><tr><td>O</td><td>USER'S CHOICE</td><td>ORIFICE, RESTRICTION</td><td></td><td></td></tr><tr><td>P</td><td>PRESSURE, VACUUM</td><td>POINT (TEST) CONNECTION</td><td></td><td></td></tr><tr><td>Q</td><td>QUANTITY</td><td>INTEGRATE, TOTALIZE</td><td></td><td></td></tr><tr><td>R</td><td>RADIATION</td><td></td><td>RECORD</td><td></td></tr><tr><td>S</td><td>SPEED, FREQUENCY</td><td>SAFETY</td><td></td><td>SWITCH</td></tr><tr><td>T</td><td>TEMPERATURE</td><td></td><td></td><td>TRANSMIT</td></tr><tr><td>U</td><td>MULTIVARIABLE</td><td></td><td>MULTIFUNCTION</td><td>MULTIFUNCTION</td></tr><tr><td>V</td><td>VIBRATION, MECH. ANALYSIS</td><td></td><td>MULTIFUNCTION</td><td>VALVE, DAMPER, LOUVER</td></tr><tr><td>W</td><td>WEIGHT, FORCE</td><td></td><td>WELL</td><td></td></tr><tr><td>X</td><td>UNCLASSIFIED</td><td>X AXIS</td><td>UNCLASSIFIED</td><td>UNCLASSIFIED</td></tr><tr><td>Y</td><td>EVENT, STATE OR PRESENCE</td><td>Y AXIS</td><td></td><td>RELAY, COMPUTE, CONVERT</td></tr><tr><td>Z</td><td>POSITION, DIMENSION</td><td>Z AXIS</td><td></td><td>DAMPER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT</td></tr></tbody></table>				FIRST LETTER		SUCCEEDING LETTERS			MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER	A	ANALYSIS		ALARM		B	BURNER		USER'S CHOICE	USER'S CHOICE	C	USERS CHOICE		CONTROL	CLOSED	D	USERS CHOICE	DIFFERENTIAL			E	VOLTAGE	SENSOR (PRIMARY ELEMENT)			F	FLOW RATE	RATIO (FRACTION)			G	USERS CHOICE	GLASS, VIEWING DEVICE			H	HAND			HIGH	I	CURRENT (ELECTRICAL)	INDICATE			J	POWER	SCAN			K	TIME SCHEDULE	TIME, RATE OF CHANGE	CONTROL STATION		L	LEVEL		LIGHT	LOW	M	USER'S CHOICE	MOMENTARY		MIDDLE INTERMEDIATE	N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	O	USER'S CHOICE	ORIFICE, RESTRICTION			P	PRESSURE, VACUUM	POINT (TEST) CONNECTION			Q	QUANTITY	INTEGRATE, TOTALIZE			R	RADIATION		RECORD		S	SPEED, FREQUENCY	SAFETY		SWITCH	T	TEMPERATURE			TRANSMIT	U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	V	VIBRATION, MECH. 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REV.	DATE	DESCRIPTION	BY
1	3/22/12	ADDENDUM #2	DG

CITY OF HAYWARD DEPARTMENT OF PUBLIC WORKS UTILITIES DIVISION	
DESIGNED BY: D. GOIT	CHECKED BY: L. D. SMITH
DRAWN BY: E. SEPENE	APPROVAL REC'D: _____
APPROVED BY: D. CLARK	APPROVED BY: _____
ALEX AMERI PUBLIC WORKS DIRECTOR-UTILITIES	MORAD FAHRAI, PUBLIC WORKS DIRECTOR
PROJ. NO.: 7511	DATE: 9/13/11

GREASE RECEIVING STATION	
P&ID GREASE SYSTEM	
SCALE: NOT TO SCALE	TOTAL SHEETS: _____ FILE NO.: _____
SHEET NO. 22	